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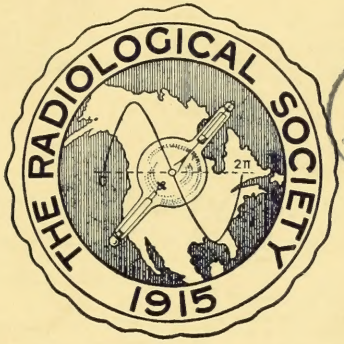

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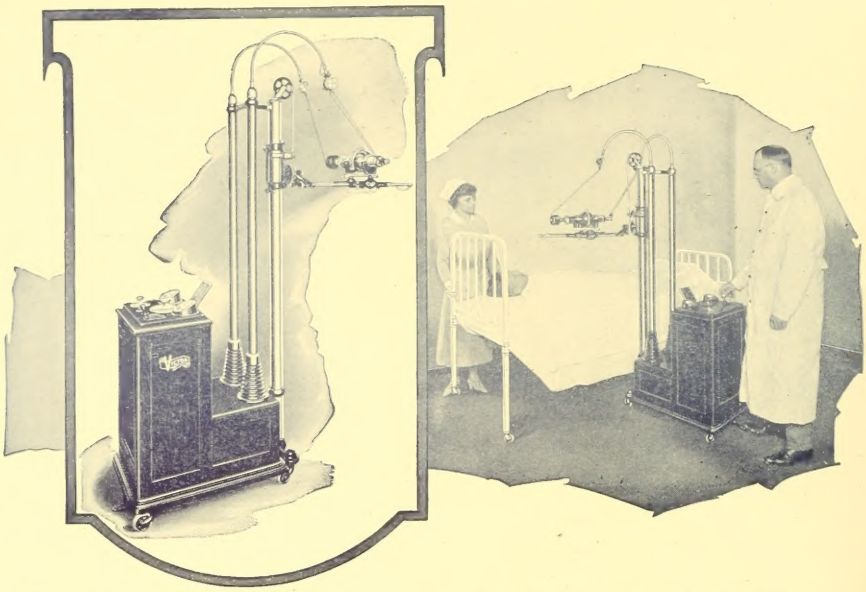

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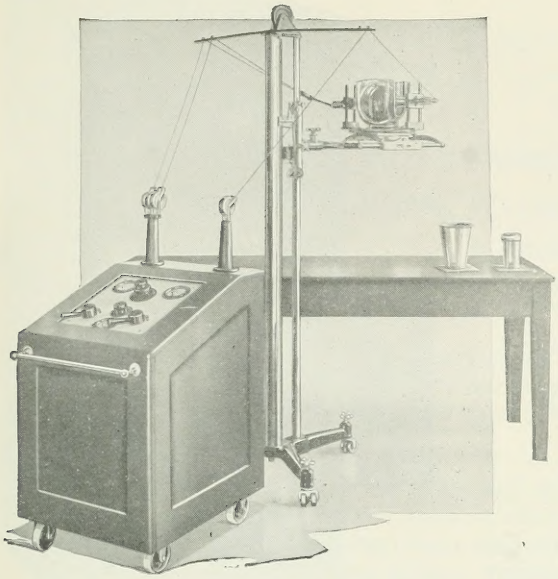

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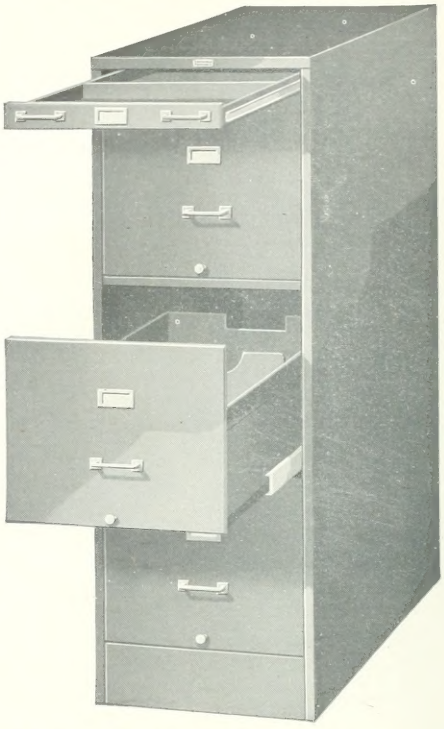

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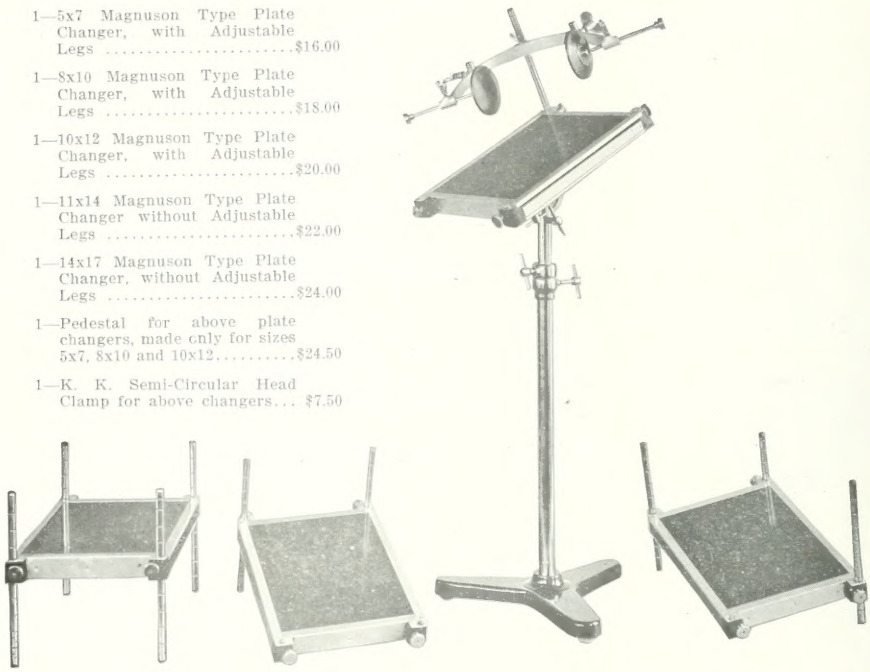

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A Roentgenographic Study of Developmental Anomalies* of the Spine*

CHARLES G. SUTHERLAND, M. B. (Tor.)
Mayo Clinic, Rochester, Minnesota

IN routine examination made in the Section on Roentgenology of the Clinic, developmental anomalies of the upper spine have been a rare finding. Congenital defects in the segments of the lower lumbar spine, particularly the fifth, and of the sacrum have been observed so frequently that a tendency to discount their significance has developed. Only a careful review of a large series of cases studied from the clinical point of view served to stimulate sufficient interest to continue reporting them.

ANOMALIES OF THE SPINE

Meisenbach, in 1912, reported the absence of the cervical spine in a girl 10 years of age. Fitch, in 1909, quoted Wertheim as having reported a case of congenital absence of the entire sacrum and coccyx in a child, and reported one case of his own in which roentgenograms revealed entire absence of the vertebrae below the first sacral, which was rudimentary, and anomalies of development in the upper fourth dorsal and seventh cervical vertebrae. Norbury, in 1913, reported a case of deformity of the spine in which the first and second lumbar vertebrae were wedge-shaped and the roentgenogram suggested an extra lumbar vertebra. In discussing this case Langmeed reported having seen a wedge-shaped extra bone between the last dorsal and the first lumbar vertebrae. Crookshank, in 1914, reported a case in which there was an absence of the lumbar vertebrae, an imperfect pelvis, and small immobile limbs. The spinal canal ended at the twelfth dorsal in a small bony boss, and there were no lumbar nerves. Decker, in 1915, reviewed the literature on numerical variations in the vertebrae and reported a case in which six lumbar vertebrae had been seen in a dissecting room specimen. He quoted Bardeen as having found, in a large series of specimens, 16 per cent of vertebral columns with numerical variations of the vertebrae. About an equal number of specimens showed increase or lack of increase in the number of segments in one section, when the other section showed an increase. Decker also called attention to the wide variety of morphologic variations seen in the spine, often in the lumbar region, and their common association with definite disturbances of body function. Kleinberg, in 1916, reported a case of congenital anterior curvature of the spine in an infant four months old and directed attention to the fact that older writers looked on this as a primary congenital lesion. Hodgson, in 1916, quoted Putti as having said that congenital or developmental anomaly in a rib surely is associated with some anomaly in the vertebra, but that the converse is not true. He also reported that congenital elevation of one or both scapulae is sometimes found with anomalies of the vertebrae or ribs. Hodgson showed many plates of anomalies of the spine and ribs. Roth, in 1920, reported a case in which an extra half vertebra on the left side, between the eleventh and twelfth dorsal segments, carried a rib. Only one-half of the ninth dorsal was present and it was fused with the tenth. Scoliosis had resulted.

REPORT OF CASES

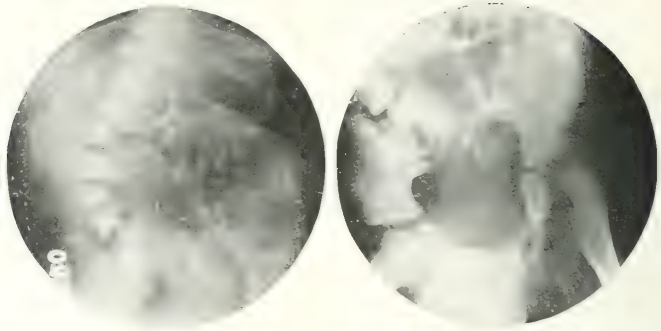
Case 1 (A210393). Anomaly of ribs and spine in a woman aged 27 years. (Fig. 1) The body of the seventh thoracic vertebra was wedged with the thin edge toward the left side. Two ribs articulated with the seventh vertebra on the right. The body of the eighth vertebra was normal in contour and two ribs articulated with it on the left. On the right the transverse process of the eighth rib was replaced by a bony bridge, which continued with it

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

Fig. 1 (A210393). Anomaly of ribs and spine in a woman aged 27 years.

Figs. 2 and 3 (A204019). Anomaly of the ribs and spine in a girl aged 11 years.

Fig. 4 (A299904).—Anomaly of the fifth lumbar vertebra in a woman aged 40 years.



Figs. 5 and 6 (A232250). Congenital deformity of the lumbar spine and sacrum in a boy aged 4 years.

and occupied the space normally taken by the ninth rib. The ninth rib was absent. The body of the ninth vertebra was wedge-shaped with the thin edge to the right. This patient came to the Clinic because of another complaint without symptoms traceable to the deformity, and the anomaly was discovered in the course of a routine examination.

Case 2 (A204019). Anomaly of the ribs and spine in a girl aged 11 years (Figs. 2 and 3). This patient had marked scoliosis of the upper thoracic vertebrae. The third and fourth ribs were fused just beyond their angles, and the body of the fourth thoracic was wedge-shaped with the thin edge toward the left side. The deformity had increased during the two years previous to examination.

Case 3 (A299904). Anomaly of the fifth lumbar vertebra in a woman aged 40 years (Fig. 4). The laminae of the fourth lumbar vertebra pointed upward with some irregularity in their juncture, while those of the fifth overlapped at the point of juncture; the left was above. The left ala of the sacrum was bisected by a groove, behind which a small process of bone ran to the ilium. The outer portion of the ala appeared to be fused with the body of the fifth lumbar vertebra and descended vertically to join the ilium. The patient gave a history of having had dull, aching pain in the groins and hips for a number of years, but clinically this was ascribed to an abdominal condition for which operation had been performed.

Case 4 (A232250). Congenital deformity of the lumbar spine and sacrum in a boy aged 4 years (Figs. 5 and 6). This child had almost complete lateral rotation of all lumbar vertebrae and scoliosis to the extent that the sacral segments were lying horizontally. There was no union between the sacrum and the ilium on the left side and on the right the articulation was through the first and second sacral segments. The spinous processes of the second and third lumbar vertebrae were fused and from them a bony process grew back toward the ilium. Articulating with the center of the process, on the lower side, a bony mass, probably a remnant of the processes of the fourth and fifth lumbar vertebrae, passed vertically to articulate with the ilium. The pelvis was markedly deformed. Sensation was lessened on the left side. There was atrophy of the muscles of the lower extremities of the left side, and the child had never walked without assistance. Sphincter control had always been lacking.

Case 5 (A164733). Congenital anomaly of the sacrum in a man aged 65 years (Fig. 7). The patient came to the Clinic because of a gastro-intestinal complaint. In routine examination a curved bony spur was revealed, growing from the left side of the fourth sacral segment downward for a distance of 4 cm., then turning at a right angle and crossing the coccyx to the right side. The patient did not have symptoms referable to this anomaly.

Case 6 (A348044). Congenital anomaly of the sacrum in a boy aged 10 years (Fig. 8). There was nonclosure of the arch in the first sacral segment, a rudimentary third sacral segment, and an absence of the remaining sacral and coccygeal segments. He had had incontinence of urine since birth and cystitis since the age of 5. Pus in the urine, and evidences of renal infection had gradually increased.

Case 7 (A166658). Congenital anomaly of the fifth lumbar vertebra in a woman aged 37 years (Fig. 9). The body of the fourth lumbar vertebra was wedged with the thin edge toward the left. The right transverse process was small and directed upward, the left, which was longer and thicker,

Fig. 7 (A164733). Congenital anomaly of the sacrum in a man aged 65 years.

Fig. 8 (A348044). Congenital anomaly of the sacrum in a boy aged 14 years.

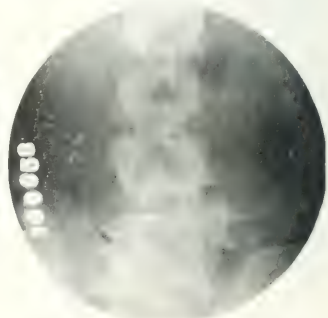


Fig. 9 (A166658). Congenital anomaly of the fifth lumbar vertebra in a woman aged 37 years.

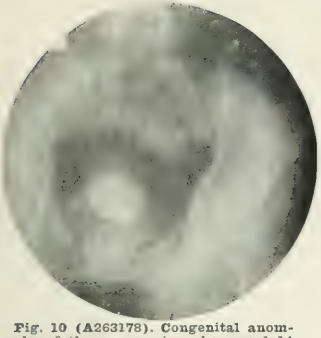


Fig. 10 (A263178). Congenital anomaly of the sacrum in a boy aged 14 years.

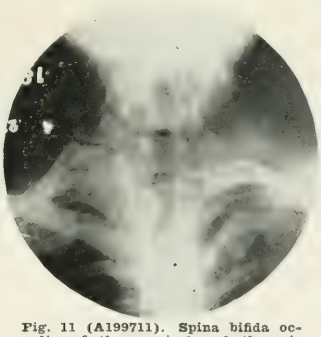


Fig. 11 (A199711). Spina bifida occulta of the cervical and thoracic regions.

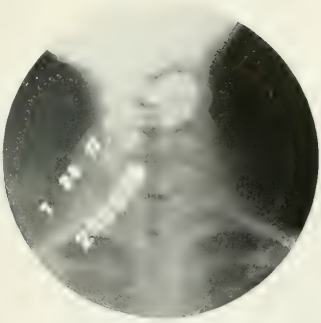


Fig. 12 (A203099). Spina bifida in cervical region.

was directed horizontally. The fifth lumbar vertebra was wedge-shaped with the thin edge to the right. The transverse process on the right was thin, small, and directed obliquely upward. Two transverse processes came from the left side of the vertebra; the lower was small and curved. The right ala of the sacrum was normal in size, while the left ala was less than half normal size. The pelvis was tilted to compensate for the wedging of the fifth lumbar vertebra. For ten years this patient had suffered from more or less constant backache, with intense pain at times between the hips and at the tip of the coccyx on attempting to rise.

Case 8 (A263178). Congenital anomaly of the sacrum in a boy aged 14 years (Fig. 10). Development of the right half of the sacrum was rudimentary, but the left half was overdeveloped, resulting in marked displacement of the sacrum toward the left. A soft tumor in the back over the region of the sacrum was found with neurologic evidences of spina bifida. The child had never had sphincter control and had had bilateral club feet from birth.

Fig. 13 (A261052). Spina bifida in the upper thoracic and cervical regions.

Spina Bifida

Chute, in 1918, reported cases of retention of urine associated with defects of the sacrum, probably spina bifida occulta, and Marshall, in 1919, reported a case of acute sprain of the spine followed by retention of urine. Woltman, in 1920, reviewed the literature and discussed the condition. He noted the occasional difficulty in the diagnosis of the occult variety. He discussed fully the various theories of the cause of this disease and concluded that it could not be explained on the basis of any single factor, but on one or more of the following: (1) abnormal character of the gametes, (2) mechanical, chemical, or physico-chemical factors influencing the embryonic rudiments, either before or after differentiation. He pointed out the roentgenologist's tendency to disregard the finding, and discussed the associated signs and symptoms. A series of reflex disturbances, faulty contour or slight asymmetry of development of the calves or buttocks, and deformities of the foot and toe often may be explained by spina bifida occulta. Hypertrichiasis is only infrequently associated; sacral dimple, persisting after 12 years of

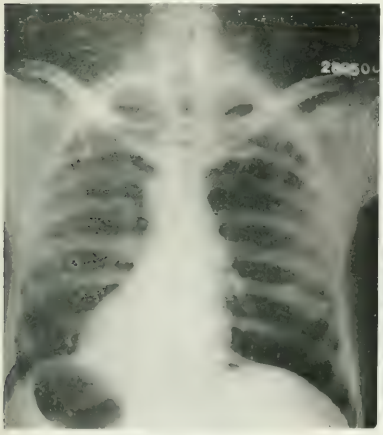


Fig. 14 (A268500). Congenital defect in the third and fourth thoracic vertebra with no signs or symptoms.

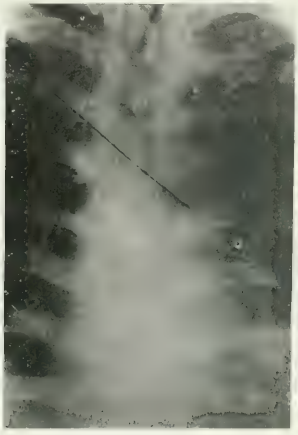


Fig. 15 (A316979). Spina bifida in the thoracic vertebra.

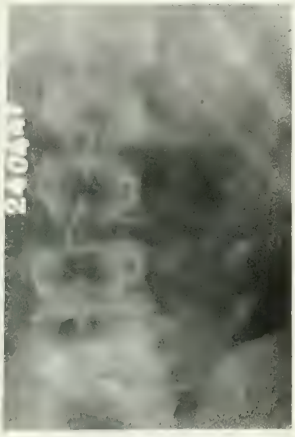


Fig. 16 (A240447). Spina bifida presenting signs and symptoms.

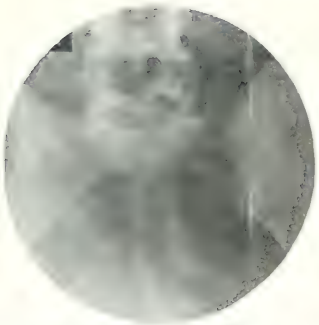
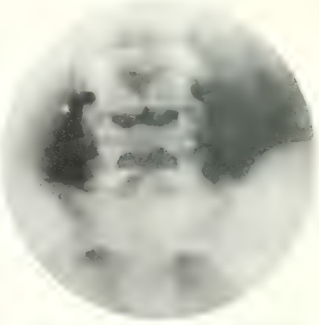


Fig. 17 (A293929). Spina bifida presenting signs and symptoms.



Figs. 18 and 19 (A341129). Spina bifida presenting signs and symptoms.

age, is significant. Disturbances of sphincter control are common, as are motor paralysis and sensory disturbances, which in no instance occur independently. Incontinence sometimes develops later in life. Enuresis, though repeatedly reported as being associated with spina bifida, was uncommon in Woltman's series. Trophic ulcers in the feet were sometimes noted after the fifteenth year.

Spina Bifida in the Cervical and Upper Thoracic Region

Five Cases

Case 9 (A199711). A roentgenogram (Fig. 11) of a woman, aged 21 years, showed the laminae on the left side of the first, second, and third thoracic vertebrae to be undeveloped, and the body of the seventh cervical vertebra much thicker on the left side than on the right. There was also a lesion on the second, third and fourth lumbar vertebrae, which suggested a congenital defect. The patient had had a torticollis since birth; the chin was turned to the right.

Case 10 (A203099). A roentgenogram (Fig. 12) of a girl, aged 14 years, showed the left sides of the fourth and fifth cervical vertebrae to be defective, and a tumor in the neck corresponded to this area. The girl was operated on for spina bifida in the Clinic. Neurologic examination showed decreased development of the left thigh and calf, pes equinus, general muscular weakness, and some incoordination.

Fig. 19.

Case 11 (A261052). A roentgenogram (Fig. 13) of a man, aged 32 years, revealed absence of the laminae of the seventh cervical and first thoracic vertebrae on the right side. He had a hairy mole in the middle line between the scapulae. There was some muscular weakness and atrophy in the left arm.

Case 12 (A268500). A roentgenogram (Fig. 14) of a man, aged 39 years, revealed a congenital defect in the third and fourth thoracic vertebrae. The right lamina of the third vertebra was absent, and the right lamina of the fourth vertebra was definitely increased in width. The patient did not have symptoms referable to the defect.

Case 13 (A316979). A roentgenogram (Fig. 15) of a man, aged 38 years, revealed congenital absence of the lamina on the right side of the second thoracic vertebra. Spina bifida of the meningocele type, with a hairy mole over it, had developed at the seventeenth year. Neurologically his symptoms were objectively negative.

Spina Bifida Occulta

Roentgenographic examination of the lumber spine and sacrum has been made in approximately 12,000 of a consecutive series of 70,000 patients in the Mayo Clinic. Six hundred and twenty-one of the 12,000 had spina bifida occulta, showing an incidence of slightly more than 5 per cent. The condition occurred about twice as often in the male as in the female. The defect was in the first one or two sacral segments in 70 per cent, in the fifth lumbar segment in 24.5 per cent, and in the lower sacral segment in 3 per cent. Associated spina bifida occulta and bifurcation with sacralization of the transverse process of the fifth lumbar vertebra occured in 2.5 per cent.

Seven Cases Presenting Signs and Symptoms of Spina Bifida

Case 14 (A240447). A man, aged 35 years, had had a trophic ulcer on the right foot for four years and a bulging in the sacral region with a palpable defect of the spine (Fig 16). Until the age of 10 he had had no control of the rectal sphincter.

Case 15 (A293929). A child, aged 4 years, had club feet and webbed

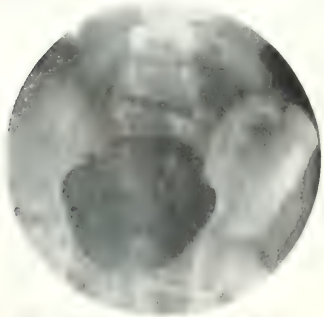


Fig. 20 (A268003). Spina bifida presenting signs and symptoms.

Fig. 21 (A280908). Spina bifida presenting signs and symptoms.

Fig. 22 (A13603). Spina bifida presenting signs and symptoms.

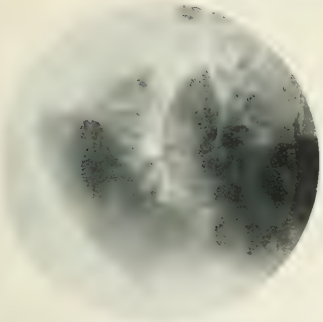


Fig. 23 (A260462). Spina bifida presenting signs and symptoms.

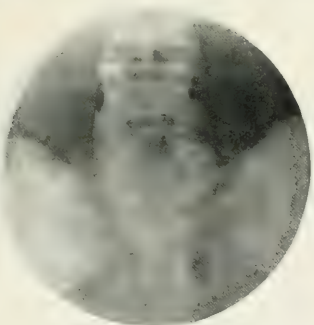


Fig. 24 (A191159). Spina bifida without signs or symptoms.

Fig. 25 (A268039). Spina bifida without signs or symptoms.

toes at birth. He had no other neurologic signs of the defect (Fig. 17).

Case 16 (A341129). A woman, aged 38 years, had a sharp depression in the upper lumbar spine; the lower lumbar region was covered with long hairs. She had no other signs or symptoms referable to the defect (Figs. 18 and 19).

Case 19 (A13603). A woman, aged 49 years, had a cystic mass, tender to pressure, over the lumbar region in the back, an ulcer on the plantar surface of the left foot, and atrophy of the muscles of the left calf and thigh (Fig. 22).

Case 20 (A260462). A man, aged 26 years, had a soft, fluctuating tumor over the middle area of the sacrum. Incontinence of urine and feces had persisted since birth, and he did not walk until four or five years of age. The patient had pes cavus, hammertoes, moderate reduction of strength in the rotatores of the thigh and in the muscles below the knee, and anesthetic areas over the buttocks (Fig. 23).

In the 621 cases reported, only a small number of the patients had signs or symptoms referable to the defect. Many cases occured in patients who had some definite pathologic condition and the finding of the spina bifida was an incident in the routine examination. Had the patients been subjected to a careful neurologic examination no doubt a percentage would have shown signs or symptoms of the condition. There was a wide variation in the types of defect and there seemed to be little relation between the extent of the defect and the signs or symptoms. Some patients with small defects had definite symptoms,

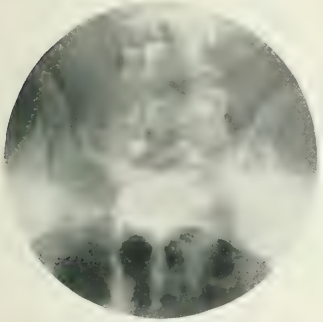


Fig. 26 (A272753). Spina bifida without signs or symptoms.

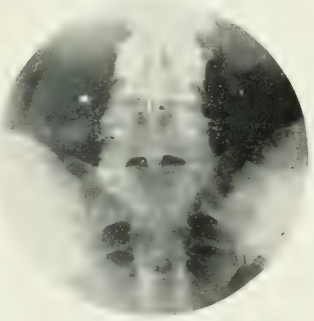


Fig. 27 (A275851). Spina bifida without signs or symptoms.

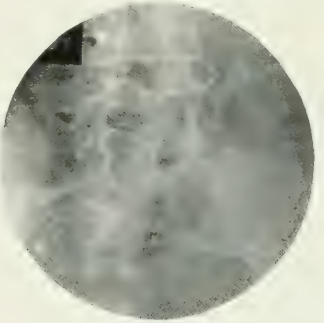


Fig. 28 (A285697). Spina bifida without signs or symptoms.

Case 17 (A268003). A girl, aged 6 years, had a syringomyelocele. The condition was diagnosed at operation (Fig. 20).

Case 18 (A280908). A man, aged 32 years, had a myelomeningocele; his condition was also diagnosed at operation (Fig. 21).

Fig. 29 (A307240). Spina bifida without signs or symptoms.

Fig. 30 (A327576). Spina bifida without signs or symptoms.

Fig. 31 (A334393). Spina bifida without signs or symptoms.

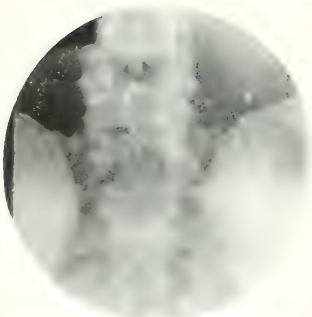


Fig. 32 (A337687). Spina bifida without signs or symptoms.

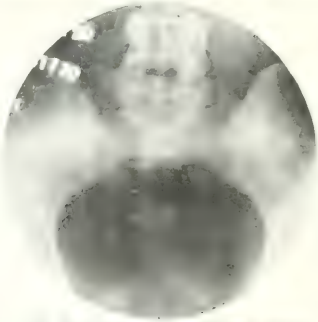


Fig. 33 (A341170). Unilateral type of bifurcation and sacralization.

Fig. 34 (A258472). Unilateral type of bifurcation and sacralization.

while others with larger defects did not show symptoms.

I have chosen nine roentgenograms showing defects without any clinical findings traceable to the defect. (Cases A191159, A268039, A272753, A275851, A285697, A307240, A327576, A334393 and A337687, Figs. 24 to 32).

Bifurcation and Sacralization of the Transverse Process of the Fifth Lumbar Vertebra

Adams, in 1910, reported a case of scoliosis relieved by operation on the transverse process of the fifth lumbar vertebra, and in 1914 he reviewed the relation of bony anomalies of the lumbar spine to scoliosis. Forty-four of fifty consecutive cases showed bony defects in the sacrum, or two lower lumbar vertebrae. He quoted various authors in accord with his own findings, and noted the importance of anomalies of the articular processes as factors. He found anomalies of the fifth lumbar vertebra so often that the normal was doubtful. Goldthwaite, in 1913, reviewed the various forms of anomalies found in the lumbosacral region and brought forward anatomic explanations for many cases of weak or painful back and for many paralyses of the leg. Henderson, in 1914, presented a study of bifurcation of the transverse process of the fifth lumbar vertebra and quoted various authors for and against the costal-element theory of the lumbar transverse process. Richard, in 1919, found that 60 per cent of 60 patients with pain in the lumbosacral region had slight or pronounced malformations of the transverse processes of the fifth lumbar vertebra. The malformation was in contact with the sacrum or iliac bones on certain movements in two groups, with the formation of a bursa in one, and with definite joint formation in one. He pointed out that ossification and union of the segments was not complete until about the twenty-fifth year, which accounted for the development of symptoms after these years. O'Reilly, in 1921, published interesting observations on the anatomic variations of the lumbosacral region and in a later paper compared the roentgenographic findings with the findings at necropsy in 28 male cadavers. In the anatomic variations he found types common to both sexes; some types were common to males and others to females. Asymmetry was the predominating feature, but the actual amount of asymmetry was less than appeared in the roentgenogram. In several cases a heavy line ran along the edge of the first sacral vertebra, which in the roentgenogram suggested displacement of the fifth lumbar vertebra, but on dissection proved to be arthritic lipping. In O'Reilly's experience the roentgenogram rarely gave an adequate idea of the extent of the arthritic changes.

Fig. 35 (A293983).—Unilateral type of bifurcation and sacralization.

In a series of 12,000 roentgenograms of the spine, I found reports of 527 bifurcations and sacralizations of the fifth lumbar transverse processes. This suggests an incidence of the anomaly of approximately 4.5 per cent. I have divided the anomalies into four types: the unilateral (Cases A341170, A258472, A293983, and A258117, Figs. 33 to 36), in which there were 23.17 per cent males and 33.54 per cent females, the bilateral (Cases A274736, A173574 and A267743, Figs. 37 to 39), in which there were 6.7 per cent males and 14.05 per cent females, the fish-tail (Case A350845, Fig. 40) in which there were 4.27 per cent males and 6.10 per cent females, and the high sacral (Cases A164905 and A212850, Figs. 41 and 42), in which there were 3.35 per cent males and 8.82 per cent females. It is apparent that this anomaly occurs in about the same ratio as spina bifida occulta, two in the female to one in the male.

I have found a few cases of bifurcation of the transverse processes other

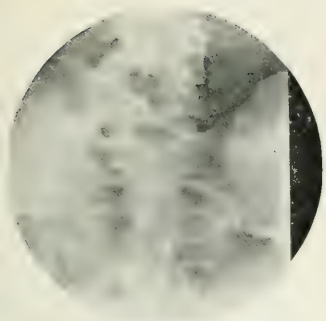


Fig. 36 (A258117). Unilateral type of bifurcation and sacralization.

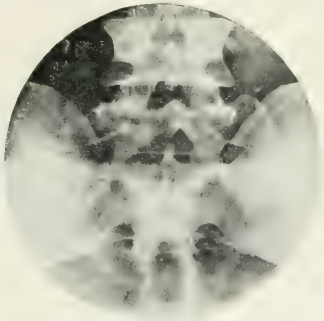


Fig. 37 (A274736). Bilateral type of bifurcation and sacralization.

Fig 38 (A173574). Bilateral type of bifurcation and sacralization.

than those of the fifth lumbar, with articulation of two processes through the bifurcation (Case A297087, Fig. 43).

The study of the symptoms in this series of cases was difficult, since in the majority the anomaly was co-existent with other pathologic conditions capable of causing about the same kind of pain that might be expected from the anomalies. The characteristic symptom seems to be dull, aching pain low in the lumbar region, increased in severity by certain movements, and pain in the hips and legs. Only a small percentage of the series presented definite evidence of symptoms referable to the defect.

In the literature may be found occasional reports of benefit derived from operation; but the opinion of most investigators seems to be for conservatism in the surgical treatment.

Summary

1. Defects in the upper spine are rare.

2. Defects in the last lumbar and the sacral vertebrae are frequent.

3. In a large majority of cases these defects are clinically negative.

4. Clinical findings, when present, include: Disturbances of sphincter control; motor paralysis and sensory disturbances; incontinence, sometimes developing after puberty; enuresis; trophic ulcers; deformities of the foot or toe and slight asymmetry of development in the muscles of the lower extremities; hypertrichiasis, infrequently associated; and sacral dimple, significant if persisting after 12 years of age.

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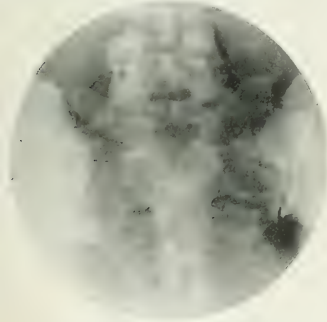


Fig. 39 (A267743). Bilateral type of bifurcation and sacralization.

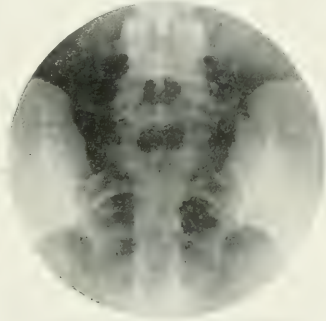


Fig. 40 (A350845). Fish-tail type of bifurcation and sacralization.

Fig. 41 (A164905) and 42 (A212850). High sacral types of bifurcation and sacralization.

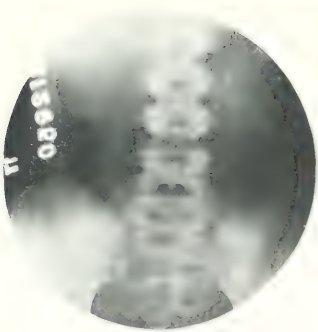
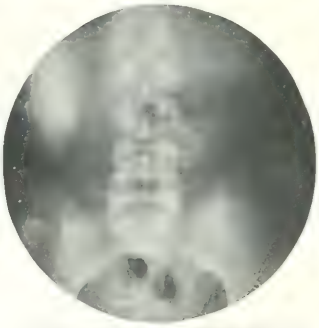


Fig. 42.



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DR. LEWALD: This is a most remarkable collection of cases of anomalies of the spine. I thought I had a few, but they are very few compared to these. There are two questions which I would like to have cleared.

First, are any of these types transmitted as an hereditary characteristic?

The second question is in regard to the association between incontinence of urine and defects in the spine as suggested by Shoot. I was not clear as to whether Dr. Sutherland had worked that out to his own satisfaction.

DR. WALLACE: I want to say a word. We ran across, two weeks ago, a case of six lumbar vertebrae, and I do not know how common or uncommon that may be. I came in when this paper was half finished. It may have been mentioned. The fifth lumbar vertebra was perfectly formed and the sixth was as mature as a great many you see in the fifth, with the transverse process and spinous process perfectly well formed. It is an anomaly that I had not seen before.

DR. ULLMANN: I should like to ask what proportion of sixth lumbar? It is not uncommon to pick up sixth lumbar and wonder whether it is first sacral lumbarized through that term. When you get six lumbar and six or seven sacral, you don't know whether you have a lumbarized first sacral or a sacralized sixth lumbar.

DR. SUTHERLAND: I personally did not take up the question of heredity as regards these congenital defects. I will send Dr. LeWald Dr. Woltman's article. I think he takes up the family history in a good many cases.

As regards incontinence, I think that is almost the commonest symptom of spina bifida occulta. That is one of the symptoms which Woltman lays a great deal of stress upon in his work.

As regards sixth lumbar, this series included a great many routine examples of the kidney, urine and bladder and in getting out my series I only retained what we speak of as the pelvic plate, so I did not go into the question of sixth lumbar. We do see it, not too frequently, but rather frequently. I would say that numerical variations in the vertebra were comparatively common if they were traced. Just the proportion I am sorry I am not able to give.

Positional Anomalies of the Gastro-Intestinal Tract*

MAXIMILLIAN JOHN HUBENY, M. D.
Chicago, Illinois

THE artifices of diagnosis are so alluring that when several different opinions are rendered, which opinions are based upon the same evidences, one wonders at the sophistries of logic. Logic is the science, art or laws of exact reasoning, however, a large amount of flexibility is introduced into the domain of medicine, or anything pertaining thereto.

In substituting tangible evidences for sophistications, the deductions are of a more substantial nature.

The roentgen examination has been a powerful factor in attaining this end, for by its aid a pictorial display is substituted for the vagaries of a diagnosis based principally on other insecure findings. Of course, the question of personal equation is a factor which must always be considered in evaluating a decision or opinion.

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

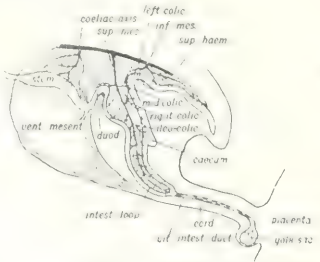

Fig. 1.—Human alimentary canal in the fifth week of embryonic life. (Diagram from Keith.)

Not so long ago it was a generally accepted belief that the thoracic and abdominal viscera occupied a relatively constant position and relationship, however, today this is not accepted *in toto*. Different classifications have been ad-

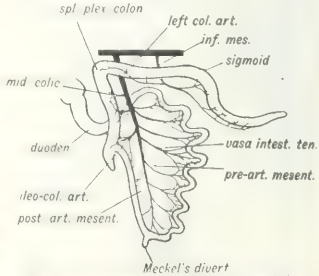

Fig. 2.—Human alimentary canal in the third month of embryonic life. (Diagram from Keith.)

Fig. 3.—The above figure shows a condition frequently seen when the first few feet of the jejunum pass to the right: (j) is on the commencement of the jejunum. The arrows indicate the direction of intestinal flow.

vanced, but these are somewhat arbitrary; the attempt towards classification and standardization is salutary, but considerable latitude must be observed in reaching conclusions. This is well appreciated today as pertains to the stomach. After all, anatomic variations *per se* are not so important, only as they indicate potential harmful possibilities, when considered from the view point of incompatibility between anatomic topography and physiology.

We are all aware of the variations of the principal thoracic structures such as the heart and the aortic arch, and the impression is vivid that the conformation and the relationship of these is normally influenced by the size and shape of the individual. Two extremes may be cited, such as the asthenic type, in the tall, thin and narrow shouldered individual, and the transverse type, in which the longest cardiac dimension tends to be transverse. A curious illustration and one that is not infrequent is complete transposition of the thoracic and abdominal viscera. To account for this atavism might bear serious consideration.

Fig. 4.—Arrested rotation of intestine: (l.) liver, (d.) duodenum, (s.i.) small intestine, (sp.) spleen, (s.) stomach, (s.f.) splenix flexure, (t.c.) segment corresponding to transverse colon, (a.c.) ascending colon, (j.) ileocolic junction, (a.) appendix. (From Huntington.)

It is now accepted, that the abdominal viscera also has variations from the usual conception of what constitutes normal position and relationship. George Johnston aptly remarked that he wouldn't care if his stomach were down in his toes as long as it functioned properly; this epitomizes the object of this paper. Many an innocent stomach has been lifted up and numerous mobile ceca have been unnecessarily anchored because of false notions regarding positions and movability. The opinions regarding the situations of the gastro-intestinal tract are just emerging to a sane plane and considerable judgment is necessary to enter a decree of former pathology. We all remember the former prevalence of nephropexy and its present limited usage; so, deterrent forces are necessary to prevent unnecessary mutilation of innocent organs.

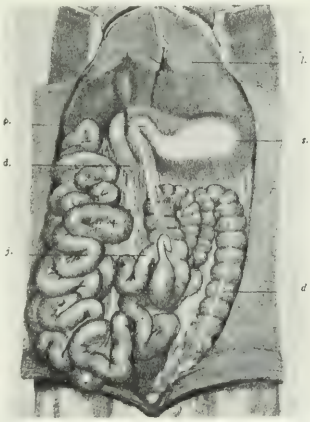

Fig. 5.—Complete non-rotation of intestine: (p.) pylorus, (d.) duodenum, (j.) ileocolic junction, (l.) liver, (s.) stomach, (d.c.) descending colon. (From Huntington.)

Most human beings are born singularly perfect and apparently free from anatomical abnormalities. Yet a tour of observation through any dissecting room will reveal anomalies present in most bodies on the table. This applies especially to the arterial system, more particularly to the visceral arteries.

The x-ray examination gives us antemortem information of inestimable value and consequently has altered many accepted notions.

The purpose of this paper is not to include positions affected or accomplished by inflammatory reactions, but to consider the subject from the standpoint of embryology.

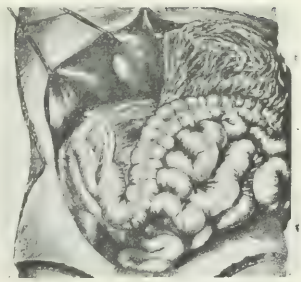

Fig. 6.—Arrested rotation of intestine: (l.) liver, (i.) terminal ileum. (g.o.) great omentum. (From Huntington.)

To understand these abnormalities, it is necessary to visualize clearly the step of peritoneal rotation, descent and fusion and the changes in the respective positions of the large and small intestines during the process.

In the fifth week of embryonic life the foregut is firmly fixed by both dorsal and ventral mesenteries. The mid and hind guts are slung up to the posterior body wall by their dorsal mesenteries only. The ventral mesenteries have disappeared. The mesentery of the midgut is long and the intestinal tube forms a long U loop from the convex end of which the vitelline duct passes through the umbilical opening to the yolk sac. Where the limbs of the U loop the fore and hind guts, there are acute bends, and the gut has little mobility above and below these points. The U loop which is supplied by the superior mesentric artery, is not able to move very freely in a lateral direction, because its apex is fixed by the attachment of the vitelline duct to the umbilicus. It is, however, able to rotate around its base where the two limbs of the U are close together. After the fifth week the midgut increases in length very rapidly, far out-stripping

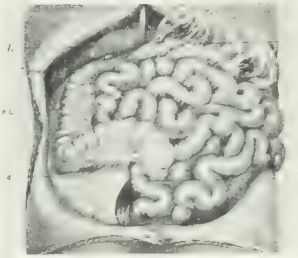

Fig. 7.—Arrested rotation of intestine: (l.) liver, (a.c.) ascending colon, (a.) appendix adherent to lateral aspect of ascending colon and to iliac parietal peritoneum, (g.o.) great omentum), (i.) terminal ileum. (From Huntington.)

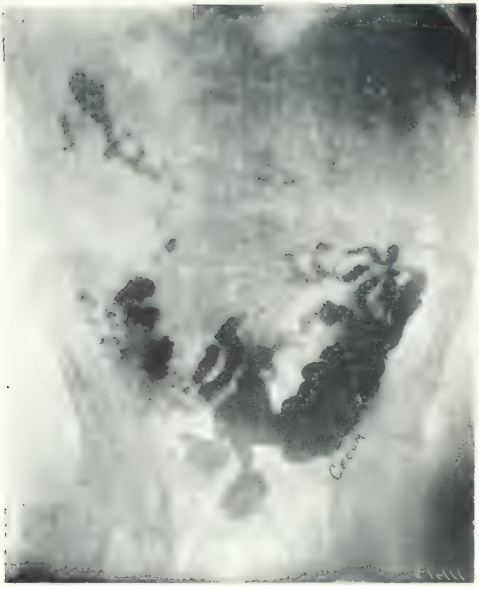

Fig. 8.—Shows position of cecum in true pelvis six hours after ingestion of opaque meal.

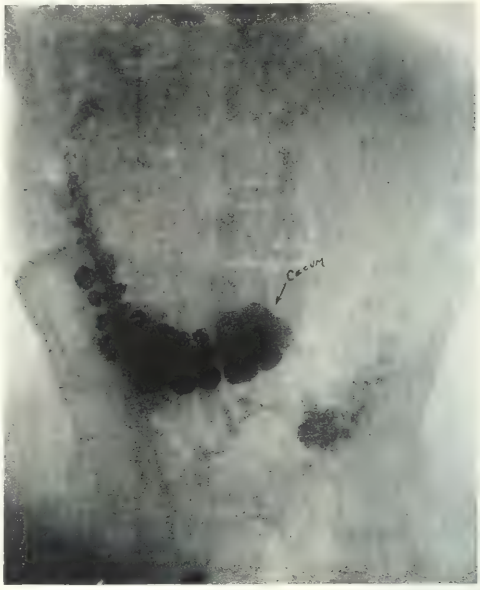

Fig. 9.—Same patient as in Fig. 8. Shows mobility of cecum; it was elevated from the true pelvis by manipulation and held in this position while plate was taken. Roentgenological diagnosis of appendicitis was verified. Symptoms were relieved. A mobile cecum need not be pathological per se; sometimes because of torsion or lack of peritoneal rotation the ileum may enter the cecum in such manner as to produce angulation with obstruction. Considerable surgical judgment is required to determine cecal anchorage.

the other divisions of the alimentary canal. Its mesentery becomes fan shaped and capacious except at the base of the loop, where the limbs of the U join the rest of the gut. Here the mesentery is reduced to a narrow isthmus, through which the superior mesenteric artery passes. At the beginning of the third month the U shaped loop twists round on this isthmus from right to left. By this twist the hind gut near the limb of the U is carried upward and to the left toward the splenic region, where it adheres and forms the splenic flexure of the colon. The rest of the colon proximal to this swings over the front of the abdominal cavity from left to right, becoming attached to the structures on the posterior body wall along a line extending from the left to the right kidney and thence down to the right iliac fossa. As the twist affects the limbs of the U loop at the isthmus, the proximal part of the midgut entering the loop is carried to the left behind the colon, and the rest of the loop twists in the same direction, so that it comes to lie free in the abdominal cavity, below the colon with its mesenteric partly reversed, the anterior face of the mesentery representing the right side of the dorsal mesentery and the posterior face its left side. At the same time the superior mesenteric artery comes to lie in front of the commencement of this part of the gut and marks the line of separation between the duodenum and jejunum. The effect of this twist is to carry the right side of the dorsal mesentery of the duodenum

Fig. 10.—Low hepatic flexure, relatively high splenic flexure, short ascending colon.

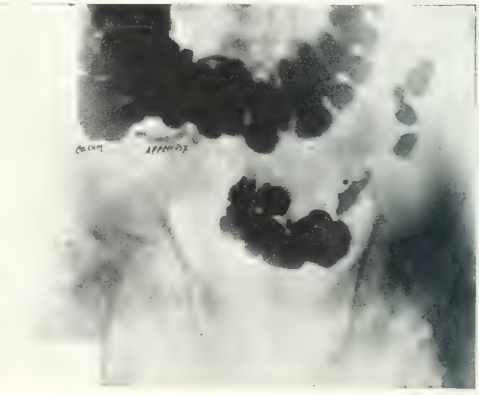

Fig. 11.—Partial descent of cecum.

Fig. 12.—Wide hepatic flexure, relatively high position.

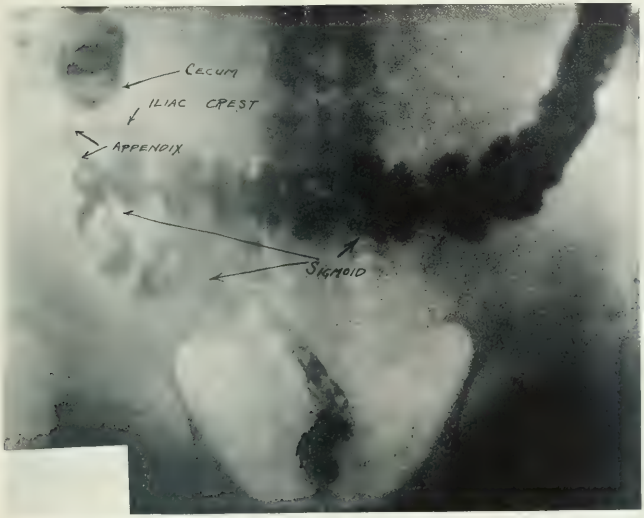

Fig. 13.—Pelvic colon, situated near level of crest of ileum. Might be surmised to be the transverse colon. Cecum and appendix seen above iliac crest.

against the posterior body wall, where it becomes attached. On reflection, it will be evident that the rotation of the U shaped loop of the intestine, followed by its adhesion to the posterior body wall, is responsible for the obliteration of the lateral spaces of the body cavities on both sides of the dorsal mesentery of the upper end of the foregut (second and third parts of the duodenum). The splenic flexure of the colon comes to lie in front of the left kidney and the hepatic over the right, while the ascending and descending colons lie in the right and left flanks.

Peritoneal adhesions form between the colon and its mesentery and the posterior body-wall, which fix the left face of the gut and mesentery to the parietal peritoneum. The right face of the mesocolon becomes the anterior face, which lies in the concavity of the free colonic loop. It is continuous along the line of the ileocolic artery with the right face of the mesentery of the small intestine. The process of fixation is probably exactly analogous to that occurring in inflammatory processes. In most cadavers irregular lines of union, leaving many pockets and crevices can be seen along the outer sides of the ascending and descending colons. At the splenic flexure, the union is very firm, being strengthened by a special band of tissue, which passes from the diaphragm and the tip of the eleventh rib to the gut (costocolic ligament). Proximal to this the fixation is less substantial. The attachment of the transverse mesocolon to the pancreas and the second part of the duodenum is quite loose and the long mesentery allows great mobility to the transverse colon. The hepatic flexure is more firmly fixed to the tissues in front of the right kidney, but there is no strong ligament on this side analogous to that fixing the splenic flexure. The ascending colon and cecum unite fairly firmly with the posterior body wall below the right kidney.

There are four principal processes involved: First, migration; second, rotation; third, descent; fourth, fixation. Variations in these normal processes may occur by excess or defect.

The cases where the first two feet or so of the jejunum pass to the right are worth notice, as it has a special bearing on the technique of the no-loop operation of gastrojejunostomy as practiced in the Mayo operation and would call for a reversal of the manner of placing clamps on the jejunum.

Every operator expects the viscera to occupy normal positions, and if he fails to find the organ he is searching for he hunts for it where previous experience has taught him he is most likely to find it. If he has been care-

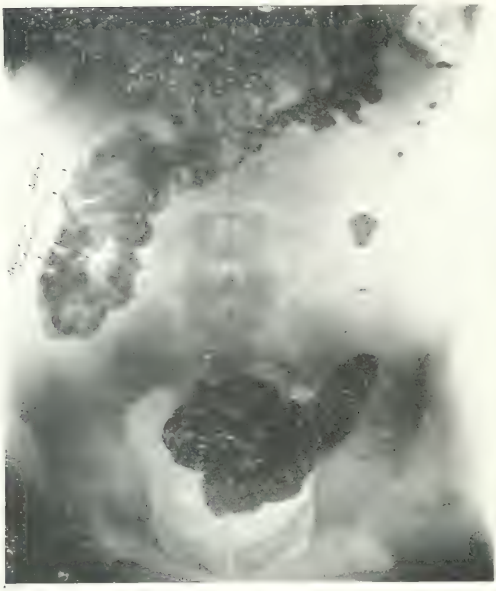

Fig. 14.—Cecum and portion of ascending colon apparently turned up and out upon upper portion of ascending colon. The appendix is seen near the hepatic flexure. Previous diagnosis of gall-bladder disease was made. Roentgenological diagnosis of appendicitis was verified. Relief was obtained. No attempt to correct location of the appendix was made, because it was apparently a case of arrested development. Potentially, it appears bad.

Fig. 15.—Unusual location of both flexures, descending iliac and pelvic colons. Roentgenological diagnosis of appendicitis was surgically verified. Patient completely relieved.

fully trained in embryology he might surmise where to look and what to observe, and if not he begins to hunt over the greater part of the abdomen, with dire consequences to the patient.

In some cases the first and second parts of the duodenum are situated usually far to the right, and if only a gastric examination is made following the ingestion of an opaque meal an error in diagnosis is highly probable, for in certain instances it has been proven that an appendix was the cause of trouble and this was only discovered after a complete gastro-intestinal x-ray examination revealed the presence of an anomaly. Pfahler's dictum of a complete gastro-intestinal examination should always be heeded, for such obvious reasons as just illustrated.

The colon offers many opportunities for variations. As regards migration the intestine might remain either in whole or in part without the abdominal cavity or pause at any point along its developmental path; such deficient migration is a matter of common surgical knowledge, in which the cecum may be found on the left side.

The variations in rotation concern the manner in which the colon and its

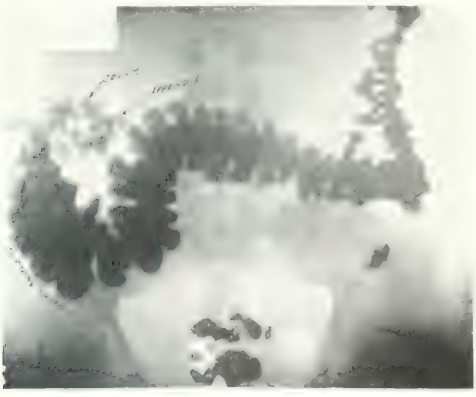

Fig. 16.—Inverted cecum ascending colon and appendix. Simulated duodenal ulcer. Surgical removal of appendix verified roentgenological diagnosis, with relief of symptoms.

Fig. 17.—High situation of cecum and hepatic flexure. Short ascending colon. Roentgenological diagnosis of appendicitis verified. Previous diagnosis was gall-bladder disease.

Fig. 18.—This and the two figures immediately following are of the same patient. Clinical diagnosis was duodenal ulcer. Roentgen examination of stomach and duodenum only was requested, however, by suggestion, a complete gastro-intestinal examination was performed, with an ultimate diagnosis of appendiceal involvement. This was surgically verified. This is an interesting anomaly. The cecum lies up in the hepatic region, is inverted, and goes down as the ascending colon, then is continuous with the transverse colon. See Fig. 19 and Fig. 20. This illustrates the necessity of complete examination of the gastro-intestinal tract.

Fig. 19.—This is the 24-hour sequel showing the location of the cecum. See Fig. 18 and Fig. 20.

rotation may be deficient or excessive. In the first event the ileum would enter from the right and posteriorly, and in the latter case, anteriorly. In abnormal rotation, combined with fixation, the ileum can hardly escape being kinked.

The normal position of the cecum is said to be in the right iliac fossa, resting on the iliac fascia, covering the ilio-psoas muscle, above the outer part of Poupart's ligament, about half below and half above the level of the anterior iliac spine. But minor variations are usually found. As regards the normal position there may be hypodescent or hyperdescent. In hypodescent the cecum lies anywhere between the region of the liver and its normal site. If the cecum goes beyond its normal position into the pelvis or develops such proportions that it is possible for it to lie in the pelvis, it is said to be hyperdescended.

Hyperdescended ceca may be divided into two groups, depending upon whether the colon is attached to the parietal wall or has a mesentery. This is interesting, as is frequently assumed that when a cecum is found in the pelvis, it is evidence of ptosis. This we are not inclined to accept; it occasionally happens that a long mesentery is present, which permits considerable mobility. Bearing this in mind it will explain the presence of so-called "phantom pelvic tumors" as elicited upon vaginal examination.

The process of fixation is a physiological fusion of contiguous peritoneal surfaces and offers numerous variations. Harvey divides these into hypo-fixation and hyper-fixation. When hypo-fixation is present a mesentery might be found; combining this with a disproportionate linear development of the large bowel, many positions of the colon, either in part or in whole can be expected.

The favorite sites for variations are the cecum, hepatic flexure, transverse colon, splenic flexure, the descending colon at the level of the iliac crest and the sigmoid. The splenic flexure is of particular interest, as it occasionally runs up as high as the diaphragm, and when filled with food may simulate a tumor mass on palpation and percussion; sometimes gas may replace the bowel contents when tympany is elicited, both these conditions might be misleading if the location of the colon were not known.

The above summary supported by some valuable clinical experiences would lead the writer to conclude that considerable reflection is necessary before pronouncing pathology present, as evidenced by variations in size, shape and position.

Great surgical discretion is required for the protection of the best interest of the patient and symptoms confirming roentgenological findings should be present before instituting such procedures as colonic resections, extirpations, anastomoses and organ suspensions and fixations.

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Fig. 20.—This is a radiogram following the injection of an opaque enema. This was done to be certain that the inferences made from the previous examination were correct. The cecum is high and inverted, the appendix is demonstrable. The ileo-cecal valve is incomplete. See Fig. 18 and Fig. 19.

Fig. 21.—This reveals location of opaque meal six hours after ingestion. Shows cecum and ascending colon near median line. Roentgenological diagnosis of appendicitis was surgically verified. Relief was obtained. See Fig. 22.

Fig. 22.—Opaque enema. This definitely verified previous examination. See Fig. 21.

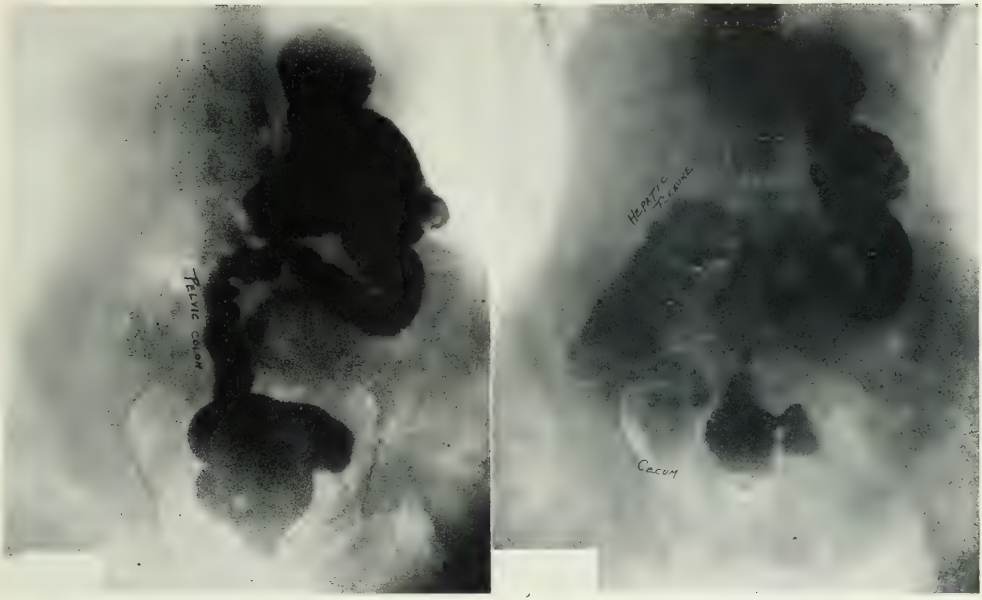

Fig. 23 and Fig. 24 are mates indicating the position of the large bowel. The location of the sigmoid, the flexures, and the ascending and transverse colons is unusual. Appendectomy gave relief from symptoms.

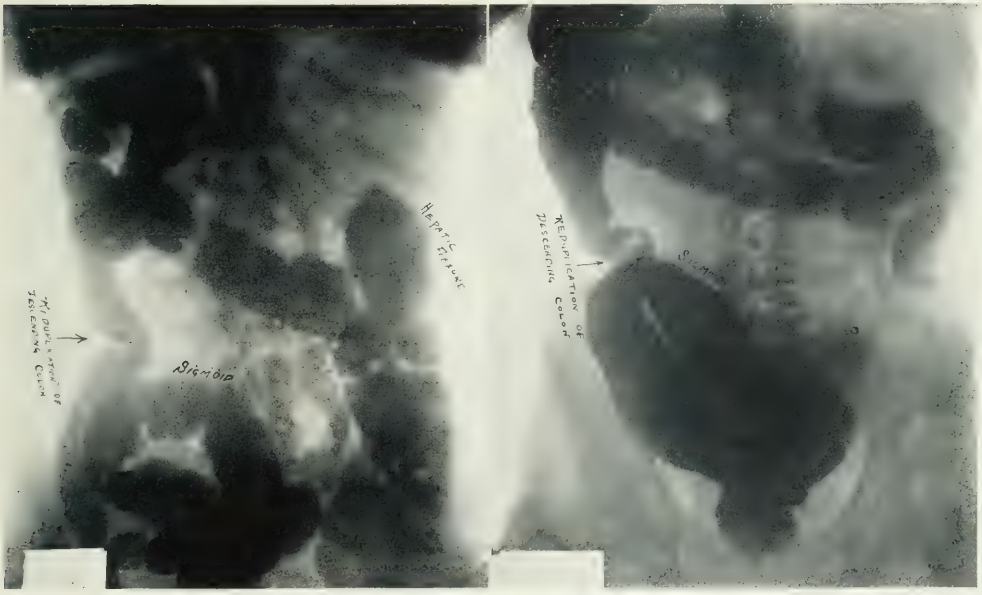

Fig. 25.—Redundancy of big bowel, particularly sigmoid. Arrow head indicates frequent seat of reduplication; in some cases obstructive symptoms occasionally occur.

Fig. 26.—Redundancy of sigmoid with spasm of reduplication of the descending colon at level of the iliac crest. No surgical interference was instituted. The acute colonic disturbance cleared up and has remained so for nine years.

Fig. 27.—Redundant sigmoid. Occasional obstructive symptoms at region of the reduplication of the descending colon. When the intermittent obstruction comes on the patient assumes an accentuated Trendelenburg position, with consequent relief (presumably an unfolding of the kink). This has been going on for seven years.

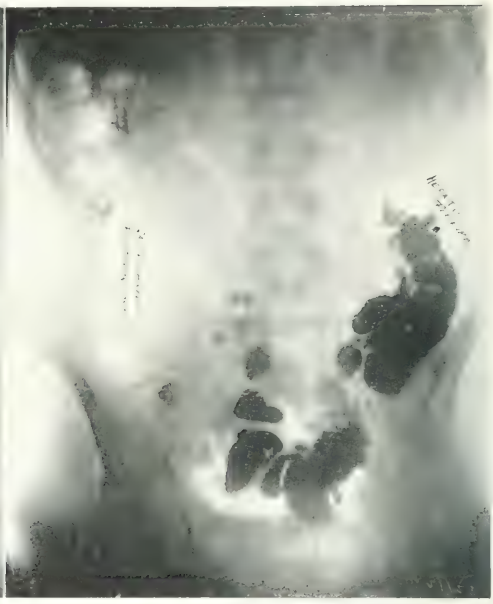

Fig. 28.—Six hours after the opaque meal. Marked gaseous distension of distal colon. See Fig. 29.

Fig. 29.—Twenty-four hours after opaque meal. New growth present at reduplicated area on the descending colon. It is possible that anatomic variations may in some instances be potentially bad.

Recent Experiences in the Treatment of Mammary Carcinoma by Means of Heavily Filtered X-Ray*

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NOTWITHSTANDING the many promises held out to the public relative to the cure of cancer by its early removal, there is a definite skepticism on the part of many well informed, experienced individuals as to the permanency of cure in the majority of female sufferers from mammary carcinoma. It requires no great effort to secure records of unfavorable results in cases where radical surgical methods were instituted within a few days of the first indication of the disease. This skepticism increases proportionately as the time between diagnosis and removal.

We have no great occasion to congratulate ourselves on the management of such cases, and any proposal for improvement should meet with kind and earnest consideration. Surgery, as applied to mammary carcinoma, has been well standardized, while x-ray technique has not. It is not probable that the x-ray is destined to occupy either the middle ground between surgery and nothing or the twilight zones of preoperative procedures and psychic or palliative measures. There is a deplorable lack of unifiormity of opinion upon the use of the x-ray in treating cancer of the breast, and the need for substantial opinions upon this subject is most urgent. This may in part be due to the fact that the x-ray is an agent not sufficiently old to have become well established, but it is also the result of insufficient team work between roentgenologists and surgeons, and the utter lack of coordinated endeavor from within our own ranks. In keeping with this thought it seems timely to enter a plea for more exact data from those who contemplate a recital of their technique in x-ray treatments.

In reviewing this subject several startling statements have been noted. One author advocates multiple areas and a time factor representing more minutes than there are in a day. He makes no reckoning of time lost in changing areas or the need of refreshment. In another account it is recorded that treatments are given through one-half mm. of copper at a 20-inch distance for 50 minutes. The question naturally arises as to the reason for selecting 20 inches and this amount of filter when the maximum out put of apparatus in use today will permit of much longer time at half this distance.

Quoting from another paper we learn that a 9-inch gap is scarcely sufficient to penetrate 6 mm. of aluminum. If this is true it is passing strange that the photographic effect through 12 mm. of aluminum is so pronounced when a 5-inch or less gap is employed.

A description of x-ray technique should leave nothing to imagination nor should imagination be permitted to supplant actual experience. An ambiguous statement which leaves ample room for speculation on the part of the reader is undoubtedly an attractive pecuniary measure, but reflects no great credit to an author and is partially responsible for varying opinions upon questions which ought to have been satisfactorily answered.

Among the first, if not actually the first, to employ the x-ray in malignant disease of this gland was a Washington roentgenologist (Merrill) and from that time up to the present, varying methods of its application with still greater variation in reports of success and failure have crept into the literature from every quarter of the world. The tendency has been in the direction of more intensive radiotherapy. In the beginning large areas were treated with no filter and modest dosage—this was followed by increase of filter, smaller areas, and increased radiation; and altogether constitutes an epoch in x-ray history. The advent of the Coolidge tube brought no very radical changes into this field excepting, only, a steady trend toward more intensive irradiation, and on the whole represented attempts at cancer destruction by fractional doses or the intermittent application of moderately filtered rays through multiple portals of entry.

Our interest in the subject of cancer treatment by means of heavily filtered x-rays with relatively high voltages, increased time and distance, through comparatively few skin areas, was stimulated by the essays of the last midwinter meeting of this society and the application of the method followed immediately thereafter. And we have accumulated evidence which we believe points the way to more satisfactory results in the x-ray treatment of cancer of the female breast.

At the present time there is a growing tendency to regard the future of deep x-ray therapy as inseparably linked with voltages of at least twice what have been used in the recent past. It would appear that we are about to don new and unknown garments without first having given the old a proper and befitting trial. It is a question if the capacity of present, universally distributed and reasonably uniform apparatus has been sufficiently and thoroughly tested and applied.

We discuss with much vigor the problems confronting us in the management of voltages ranging from 150 to 200,000, and speculation is rife as to the therapeutic consequences.

That unusual experiences are in store for us no one will deny; that newer methods and newer apparatus will come seems equally assured, but to await their development without first knowing the possibilities of apparatus at hand is, to say the least, unwise.

The physics of higher voltages is unquestionably interesting, and to the average roentgenologist similarly elusive.

No one knows in plain English phrases and figures how much electrical energy expressed in American volts is being delivered to x-ray tubes in other parts of the world, but we have observed during the past year the effects of x-ray treatments secured by passing 5 ma. through a Coolidge tube at a 9-inch gap, 10 and 12-inch distances, ½ mm. Cu filter, three hours time to each area, and it is to these procedures that your attention is directed.

We have met with the usual unsatisfactory experience in deep therapy for cancer, as a general proposition. Some few cases have responded to older methods with highly gratifying results, but the majority have succumbed to cancer.

The technique above referred to we adopted in February, 1921, and we have applied it generally to cancer of all types and parts excepting the superficial skin epitheliomas. However, its use was restricted in the beginning to recurrent carcinoma of the breast, and it is with carcinoma of the breast that the observations in this communication are concerned.

After a few preliminaries we began this treatment of postoperative recurrent cancer of the breast through three or more portals of entry, giving to each area a full three hours time. It was our aim to include in every case all of the affected side, both front and back, the supra-clavicular and axillary spaces, and when deemed best the op-

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

posite breast as well. Thus a patient would receive nine or more hours of x-ray, given as rapidly as possible. We found, however, that a maximum of

on any one day for the average patient.

It is not unlikely that a technique will be worked out whereby the patient will be treated for the full time over one area, or three hours, but for the present this is not being done, and unless measures directed to the control of x-ray sickness are suggested, it will in certain instances be an insurmountable difficulty. X-ray sickness generally under this treatment seems to be not more violent, but is more prolonged.

vomited excessively after forty minutes of treatment, notwithstanding the fact that the usual measures had been used to prevent it, and another who had previously received the most intensive roentgen ray by the old method without having

nauseated during her first prolonged treatment, vomited profusely almost continued vomiting at intervals through

another, a young colored woman, has experienced only anorexia after treatment for a few days, although she has received more hours to date than any other patient.

The effects upon the skin vary from a roughened, bran-like elevation of the epidermis to actual vesiculation, with slipping of the skin in several instances, but the ultimate result is a varying shade of brown with a smooth, somewhat thickened integument. In the blacks the skin takes on a deeper pigmentation.

Palpable tumors respond early and in our experience without a single exception. Their decrease in size and induration is synchronous and progressive, beginning to reduce and soften within ten days. Recurrent nodes of the size of small marbles have disappeared in a month, leaving no trace whatever. In one instance five radium needles were buried in both sides of a recurrent tumor, approximately the size of a lemon, for twelve hours to the side and subsequent three-hour treatment given. This was paralleled by another case also of identical as to the size of the tumor, but no radium employed. The tumors in both instances were destroyed. We do not draw definite conclusions from this fact, in general we feel that radium is probably supplanted by the x-ray used in

region. The burying of needles or implantation of cancer cells necessitates breach through lymphatics and blood vessels and is to be avoided.

Certain effects have been observed upon the lung structure which cannot be either definitely or accurately described. We have noted very early parenchymatous infiltration in the lung after treating an overlying cancer of the breast, which has undergone regression subsequently. Whether this represents edema or lung destruction, is not known. Pleural exudate has been observed to follow treatments with symptoms of pleurisy of a mild type. The lung space seemed to decrease in other cases which have been associated with dyspnea and evidences of scar tissue formation, but later the difficulty in breathing is relieved to a great extent, which may in part be due to compensatory emphysema of the opposite lung. Still other cases show no demonstrable effect by x-ray examination. The subject is one, therefore, not capable of being accurately analyzed at this time, and it is recognized that certain of the [illegible] phenomena followed former methods of x-ray treatment.

In certain unfavorable cases this technique has unfortunately added rather than subtracted from the patient's suffering, but by way of defense, we submit that they were all postoperative, and, in our opinion, not properly selected as operable types.

The millennium in x-ray therapy is still postponed for a considerable number of cases of cancer of the breast in which there is extra mammary adenopathy at the time of surgical interference. No amount of treatment is adequate in controlling the persistent and widespread metastases in many of these sufferers, for, as is well known, the virulency of the disease is materially augmented by surgical operations, regardless of their extent.

The rapidity with which palpable and perceptible lesions in frankly inoperable types have disappeared is highly encouraging and justifies the hope that continued experience along these lines will mark a new era in medicine, for it must be admitted that the present one dates back at least 2,000 years when radical removal of the female breast for malignancy was first advocated and practiced. Even the temporary removal of demonstrable lesions in inoperable mammary cancer by a method comparatively free from hazard, and of prolonged period of invalidism, assuredly not only an innovation, but should command general, serious and friendly consideration.

It is extremely doubtful if either preoperative or postoperative therapy has accomplished more than a postponement of the fatal issue in cases which prevented metastases into neighboring lymph nodes at the time of operation. It is highly problematical that pre-operative x-ray therapy has accomplished anything and it is the height of folly to expect more in the future from a fairly thoroughly applied measure than has been experienced in the past.

Our experience leads us to the inevitable conclusion that, as a general rule, a woman afflicted with cancer of the breast, in which there is a tumor with extra mammary adenopathy, may expect better results from x-ray therapy administered as heretofore described than from any other form of treatment, and while we acknowledge the vast experience of others, we hold that this is true.

By way of retrospection the only argument in favor of the fractional dose method of x-ray therapy, aside from a material one which doubtless has appealed, is that in some mysterious way the resistance of body cells is supposed to be stimulated to a point whereby a cancerous growth is destroyed.

If this were the case, it would be not only advisable, but reasonable to treat superficial lesions by the fractional method. On the contrary, it is our belief, based upon the long experience of one of us (Groover), that prolonged fractional dosage has the effect of possibly increasing the resistance of cancer cells to the x-ray in certain instances. However this may be, the massive dose method of treating superficial lesions whereby the growth is wholly destroyed in one or two treatments seems to us to be a vastly superior technique and we can see no reason why deep seated cancer should now constitute an exception.

The current issue of the collected papers from the Mayo Clinic contains a description of their technique in the x-ray treatment of cancer of the cervix in conjunction with radium used locally. The subject is brought to your attention for the purpose of analyzing procedures in deep x-ray therapy in common practice.

Quoting from their article, "four to six areas over the lower abdomen are treated for four to five minutes each, with 9-inch gap, 9-inch distance, 5 ma., 4 mm. Al, and same areas posterior Treatments every three weeks." Now this technique is employed for the purpose of destroying cancer cells some distance from the surface. The most that can be said or claimed for the system is that it represents the fractional method of attempting cancer destruction, but when we consider that a superentire dosage it is expecting too much to hope that deep seated lesions will do more than thrive as a result of it, and the absolute accuracy of cross-fire is admitted for argument's sake.

It is our practice to treat superficial inch distance, 8-inch gap, half of cancer for ninety ma. minutes at 8-

the treatment with but 1 mm. of Al, and we have given 100 ma. minutes with the above factors without filter and without accomplishing anything more than complete destruction of the part treated.

We hold that it would not be bad practice to administer 150 ma. minutes, 9-inch gap, 9-inch distance, with 4 mm. of Al to a superficial cancer, and this is a multiple of the maximum number of doses given over the anterior abdomen to destroy cancer cells on a level with broad ligaments, as set forth in the article above mentioned.

The x-ray treatment of cancer will not be successful until, as we have pointed out before, "the amount of x-ray delivered will stop just short of accomplishing more harm than good," and, in our opinion, the fractional dose method in deep x-ray therapy is doomed just as the fractional dosage of superficial malignant lesions has passed into history.

The question naturally arises if anything is being gained by increasing filtration up to ½ mm. of copper without raising the voltage above the equivalent of a 9-inch gap between blunt points. The author is certain that the maximum skin dose with 6 mm. of aluminum, 5 ma., 9-inch gap, and 12-inch distance can be secured in forty minutes. It is also certain that this dose may be safely repeated to an area if a four or five days interval between treatments is allowed. It may be worth while to record the fact that the above technique applied for one hour will result in a very intense reaction, which is characterized by vesiculation and loss of skin, and that by dividing the dose, allowing some days to pass, it may be repeated with resulting skin reaction of little or no consequence.

Whether the results secured by using the above factors with a 6 mm. Al filter, giving forty minutes with an interval of a few days before repeating, is approximated by using one-half mm. Cu filter and three hours time, cannot be stated from any practical experience we have had.

The Planning and Equipment of a Modern X-Ray Laboratory*

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INDUSTRIAL concerns have long recognized the value of efficiency engineering whereby their manufacturing processes are conducted with the minimum amount of waste and lost motion. Proper designing of his offices will accomplish the same purpose for the roentgenologist and save much physical effort and mental strain. The laboratory should be considered as a manufacturing plant in which the patient as the raw material is routed through at a maximum speed and a minimum inconvenience. Congestion of any part of the plant should be avoided, and this [illegible] be accomplished by a little [illegible] appointments. The average patient does not come to a doctor for pleasure and is very glad to get away as soon as possible. A large amount of work can be turned out in a short time and intervals of leisure obtained for rest and relaxation.

X-ray laboratories fall into two classes, institutional and private. The one is in a hospital or research institution while the other is a part or whole of a physician's office. There is no essential difference between the two as the mechanical equipment is the same in both. The private laboratory has usually a more elaborate arrangement of rooms as its clientele is composed of outpatients.

An x-ray laboratory may consist of one room with a dark room in the corner or the whole floor of an office building. Equally good work can be done in either, the only difference being in the quantity. Two sizes only will be of interest to the great majority of roentgenologists. One is a city laboratory with a flourishing business manned by the physician and one or more assistants. The other might be called a "one man laboratory" after the automobile top which, theoretically, can be handled by one individual.

The larger one should cover at least one thousand square feet of floor space and if possible should be in a new building, as a remodeled job is very expensive. The rooms should be so arranged that there is a natural division between the public and private portions. Furniture, rugs, hangings and decorations should be of good quality and taste, but subdued rather than ornate. An x-ray laboratory is a work shop, not a drawing room, and its furnishings should be with this in view.

The public portion is for the reception of patients, physicians, and business callers. It should be located in the part of the suite nearest the front of the building and should comprise a reception room, display room, and consultation room.

In the display room are the negative illuminators, stereoscope and record files. A negative file should also be provided large enough to contain a year's work. The clerk's desk can be supervise the reception room and teleconveniently located here, as she can phones, and still be in the same room where the bulk of the record work is done.

A consultation room or private office for the owner is very desirable. There he can see business callers, transact his personal affairs, do his reading, and what is of great importance to many, have a place to smoke.

With these rooms located as described the public part of the suite is by itself. Physicians can come in and look at negatives and lose no time. Business callers can be seen and friends met without any interference with the privacy of patients being examined.

The private or work rooms fall into two classes, those in which patients are examined and the accessory space such as dark rooms and dressing rooms.

The heart of the plant is the machine room. This contains the transformer, Coolidge transformer, and time switch circuit breaker. It may be located in the basement or in a small room on the same floor. The switch board, time switch, and Coolidge control are centrally located with proper lead protection for the operator. A main switch which will cut off the current from every piece of apparatus is a necessity.

Emergency high tension lines can be constructed from clothes line, broom stick and bell wire, but a modern laboratory should have the best aerial system that can be obtained. It is safe, convenient, insures accurate technique and gives a finished appearance to the equipment. With it one transformer can serve as many rooms as desired by duplication of high tension switches but all these rooms should be within the vision of the operator to avoid accident.

In order to avoid congestion there should be at least two rooms supplied by the transformer. One may be used for general radiographic work and the other for treatment. If there is much dental work a dental unit and chair will be a great time saver. This unit should be as near as possible to the reception room. If the radiographic room is large enough it may contain the fluoroscopes but a separate room is desirable if space permits. To those with surgical training the fluoroscopic reduction of fractures and removal of foreign bodies offers a very promising field for development. As this work usually requires an anesthetic a separate room is an absolute necessity. These rooms should communicate with each other and also open into a corridor so that patients may be introduced into any one at will.

The equipment depends upon the doctor's purse, the quantity and kind of work done, and the energy of the salesman. One transformer will serve the treatment and radiographic rooms and also the fluoroscopes if a remote control switch is used. If much fluoroscopic work is done a fluoroscopic unit will be found useful and, by proper arrangement of high tension switches, can be used for radiographic work in case of breakdown.

The radiographic room contains a stereoscopic tube stand and stereoscopic plate changer for chest and abdominal work. If there is a separate fluoroscopic room a plain wood table on castors answers the purpose admirably. It is light and easily pushed around and eliminates much of the danger of injury to the patient from a ground. It should be low enough for an injured patient to get on easily without being lifted. Combination outfits economize space but are expensive and not so flexible. For wrist and elbow work a light stand on castors about eighteen inches square and thirty inches high is very useful. The Buckey diaphragm is one of the essentials. Its bulk and weight renders its routine use awkward but tables are now being advertised which will render it always quickly available. A cupboard or closet should be provided for space tubes, cones sand bags, etc. For those who use plates, twelve gauge sheet steel cut to the proper size and nickel plated will be found useful to prevent breakage when placed under patients.

The treatment room must be well lighted and ventilated. The equipment consists of a comfortable couch and tube stand. The tube should be enclosed with suitable protection and equipped with an exhaust fan for cooling. A cupboard should be provided

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

containing filters, sheet lead, lead foil, rubber cloth etc.

The fluoroscopic room opens into the radiographic room and contains both vertical and horizontal instruments. A combination outfit may be used, but it is very expensive and takes as much room as two separate machines. If the transformer is used for fluoroscopic work the rheostat should be in the circuit to prevent accident in case of a ground. A three point foot switch is connected to different rheostat buttons, giving a choice of voltage without changing the settings. Both a white and blue light should be in the ceiling, the white light switch at the door and the blue light attached to the foot switch.

Dressing rooms are a necessity, especially for women patients, and obviate tying up the workrooms. These rooms need not be larger than four feet square and contain a chair, mirror and coat hooks. They may be more elaborate with a mahogany dressing table and chair, lamps, powder, etc, but so much magnificence is unnecessary.

Ample storage space should be provided to contain stationery, linen, tubes, eye localizer and all the miscellaneous odds and ends that are needed. A great deal of effort can be saved if there is a definite place for each article.

The dark room should have more thought given to its planning than any other part of the suite. It must be close to the picture rooms, have a window for ventilation, be easily and quickly made light tight, and as compact as possible. Any portion of it should be reached by two or three steps and yet there should be room for two people to work together. This can easily be accomplished in a space seven by ten feet exclusive of the entrance. The entrance may be a maze, double swinging doors or double sliding doors. The latter are the most economical of space, but usually must be installed when the building is constructed. The window should be four feet from the floor and furnished with wooden shutters. These may either be hinged to the casing or slide in grooves like the sashes. The latter arrangement gives an absolutely light tight window, easy to open for ventilation and does not take up any space.

The equipment consists of a sink, tank, shelving and miscellaneous articles such as developing racks, trays, glassware, etc. The sink should be at least 20x30 inches, with solid back, and hot and cold water. Over it is an illuminator with a 14x17-inch opening for viewing wet negatives.

With the almost univrsal use of films the large Bowen tank is a necessity, as the film hangers take up a great deal of space. There should be a permanent cold water supply in the wash compartment with valve. On the wall in the middle of the tank should be a combination hot and cold water fixture to which a hose is permanently attached hanging in the spillway. On the same side of the room is a shelf 24 inches wide, level with the tank. This will hold the plate drying racks and be very useful for making prints and mixing solutions.

On the other side is a 24-30-inch shelf 40 inches high and as long as possible. All the loading and unloading is done here safe from any danger of contamination from solutions. The space under the shelves is utilized for the storage of containers for mixing developer and hypo, and plate and film storage. The photographic material should be in a lead covered cabinet to protect from fogging. Overhead on both sides of the rooms are two shelves 20 inches wide and 24 inches apart, the bottom one 72 inches from the floor. The space between is divided by vertical partitions into pigeon holes from eight to ten inches wide. In these are stored envelopes, plate developing racks, printing frames, trays, etc.

A very important thing is a place to dry plates and films. Plates may be conveniently dried in racks without taking up much space, but films present a different problem. The simplest way is to stretch a cord or wire across the room, but this is very messy on account of the drip. A space 16x26 inches in one corner will accommodate 24 developing racks. Two thin boards with notches one inch apart on their upper edges are spaced 14½ inches apart paralled to each other. The racks are hung in these notches and a large tray put under them to catch the drippings. This tray will cause no extra work, as the water will evaporate. A fan may be attached a few feet above, which will insure quick drying.

The most scrupulous order and cleanliness is necessary in the dark room, although the reverse is usually the case.

The small laboratory should be as compact and as inexpensive to equip and maintain as possible. It should contain a reception room, radiographic and dark room, and if possible a combined consultation and display room.

If treatment work is to be done a large machine is necessary. It can be placed in one corner with a lead screen for protection, or, if there is available space, in a hallway or closet. If treatment is not contemplated a fluoroscopic unit with sufficient capacity to supply a thirty milliampere radiator tube may be substituted. The transformer of this unit is hung on the wall and much space, as well as first cost, is conserved. A high tension switch directs the current to the vertical fluoroscope or tube stand. A fluoroscopic table may be used, but will materially increase the investment. A stereoscopic plate changer should be provided either as part of the table or a separate instrument. A combination table and tube stand will economize space, but is expensive and not so flexible.

A space six by eight feet will amply accommodate the dark room. A wide shelf on one side and small tank and sink on the other with shelving as described above will give a very handy and compact arrangement.

If possible there should be another room for the physician's desk, records and files. The stereoscope may be placed here and will also serve for an illuminating box.

The ideas stated above represent general principles only. No one plan can be adopted as best for individual tastes, and architectural problems exert a modifying influence. If, however, the thought of economizing time and effort has been developed the purpose of the paper has been achieved.

ULTRA VIOLET RADIATION

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WHEN an electric current is impressed, uni-directionally, through the vapor of mercury enclosed in an exhausted quartz tube, there occurs a series of progressive changes that reach a stable equilibrium in about fifteen minutes. This equilibrium is characterized by the production of an intense illumination offering a relatively large proportion of ultra violet energy; a proportion greater in quality and quantity than that issuing from any other known source. Jeune, in his "Lampes a Vapeurs de Mercure," gives a comparison of the various sources of ultra violet energy as follows:

Source	Infra-red	Light	Ultra-Violet
1—Mercury Vapor	52%	20%	28%
2—Sunlight	80	13	7
3—Arc Lamps (such as carbon)	85	10	5
4—Incandescent Lamps	93	6	1

It is not enough to know that the mercury vapor arc is the richest available source of ultra violet energy. It should also be recognized that the quality of the spectrum derived from the quartz tube is vastly superior to that derived from any other agent. So that it is fitting to say that the quartz mercury vapor arc, in its modern form, represents a most efficient instrument for use in connection with clinical accomplishment.

Essentially, there are two types of mercury vapor tubes. One type consists of a vacuum arc in a fused quartz chamber. In this the discharge takes place between the anode and the cathode electrodes, both electrodes being liquid mercury. Another type, and a more modern one presenting certain important features over the older type, consists of metal (tungsten) lead-in-wire sealed directly to the quartz burner. Within the burner the cathode is metallic mercury, and the anode is a flat coil of tungsten wire.

Burners

In the commercial development of the quartz mercury arc lamp the pioneer work is due to the Heraeus firm in Germany; and since tubes may be found on the American market, which are patterned after the principles first introduced by Hareaus, it is important that a complete understanding of this type of burner be had. (1)

It consists of a quartz tube connected at the ends to the two mercury-filled reservoirs. One of these reservoirs serves as the anode and the other as the cathode. The tube is shaped differently near the reservoir. Toward the anode reservoir the arc tube is in the form of a sloping roof; whereas near the cathode reservoir the tube takes the form of a narrow, thick-walled, contraction. Each reservoir has attached to it a small quartz tube, which carries a metallic conductor through which the current is impressed. The tube is exhausted to a fair vacuum.

Says Weintraub:

> "The 'ground joints' are attached to the reservoirs. It is not possible to seal metallic conductors into quartz in a manner similar to that common in exhausted glass vessels. A metallic conductor with a coefficient of expansion near that of quartz is found in a certain alloy of nickel and steel, but as the melting point of this alloy is too low, and sealing it into quartz is impossible, recourse is taken here to a ground joint between a conical nickel steel plug and quartz. As one ground joint is not perfectly vacuum tight, two such ground joints in series are used and a seal of liquid mercury is placed on the top of the upper ground joint. On the whole, these ground joints if properly made are satisfactory so long as they are not exposed to any considerable temperature rise. This limitation has the disadvantage of reducing the number of possible designs of the lamp."

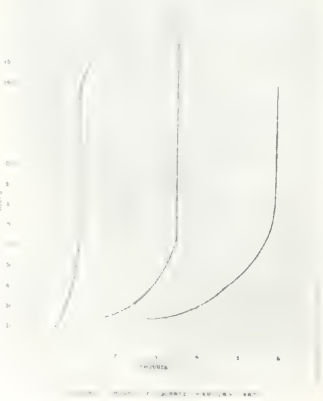


Fig. 1.

As compared to the arc tube, the mercury reservoirs in the Heraeus type of burner are a very large size. This is necessary, as can be surmised by study of the volt-ampere current of quartz mercury arc lamp, shown by the curves on Fig. 1.

These curves show that when a certain current is reached the voltage rises very steeply. For the reasons of light efficiency, the quartz lamps operate on that part of the volt-ampere curve which is straightest; in other words, the quartz lamp under conditions of operation is a constant current device, so that no matter what voltage is impressed, or how much resistance is in series, current above a certain maximum value can not be forced through the tube. It is known that the constant current value depends primarily on the size of the mercury reservoirs by reason of the rate at which heat can be dissipated from their surfaces. For example, the curves obtained in Fig. 1 were derived by varying the size of the electrode reservoirs. In order to impress a current of even three and one-half amperes, the size of the reservoir has to be extremely large, so large as to interfere with practical utility; and therefore the heat dissipation must be augmented by an auxiliary means such as the attachment of metallic wings to the reservoir. Thus, in the Heraeus type of burner the heat dissipation control is a complicated one that involves the size of the reservoir, the number of metallic wings attached and the arrangement (distance apart) of the metallic wings.

More heat is generated at the anode than at the cathode; and unless certain precautions are observed the anode mercury would distill over into the cathode. While this could be prevented by increasing the heat dissipation of the anode as compared to the heat dissipation of the cathode, this method would not yield a satisfactory control. The commercial expedient still used in this type of burner is to shape the tubes differently near each electrode. For instance, the cathode reservoir is connected to the light given tube by a contracted part, in such way that, during the luminescence of the arc, the mercury remains in this contracted space. This introduces a narrow column of mercury

between the reservoir and the arc which conducts the heat away with difficulty, and tends to increase the rate of vaporization of mercury at the cathode as compared to that of the anode.

Tungsten Mercury Electrode Burner

This development is a result of the work carried out in the Lynn Research Laboratory of the General Electric Company. Weintraub writes:

"The first problem attacked and solved was that of introducing current into exhausted quartz vessels, not by means of ground joints but by means of metallic wires sealed-in in a vacuum tight manner.

"In principle, the method used is that of interposing between the quartz and a suitable metallic wire different glasses of variable coefficients of expansion. The coefficient of expansion is in the neighborhood of 0.5×10^{-6}; the coefficient of expansion of platinum, which is the metal used in glass seals, is in the neighborhood of 9.0×10^{-6}. The glass on the market with the lowest coefficient of expansion has an expansion of about 3.5×10^{-6}.

"To make possible the connection of this low expansion glass with lead glass, six intermediate glasses were necessary, these glasses being obtained from the glass factories.

"To connect quartz to the low expansion glass, glasses were needed with intermediate coefficients of expansion. After considerable work, glasses filling the requirements were prepared and it was found that four such 'intermediates' were necessary to produce a reliable joint. In all, ten different glasses were therefore necessary to enable one to seal in platinum wire. This large number of intermediates made the method expensive, and it was also found that the reliability of the joints between the low expansion glass and lead glass was not sufficient for shop use.

"Fortunately, we soon made the other and equally important discovery that tungsten wire could be sealed into the low expansion glass in a vacuum tight manner. The number of intermediate glasses was, therefore, reduced to only four, and tests on a large number of these seals have shown them to be reliable. They stand higher temperatures than any other vacuum seal, and, due to the higher electrical conductivity of tungsten, can carry more current for a given cross section. The tungsten leading-in wire, in combination with low expansion or heat-resisting glass, is also being used in a new type of rectifier and bids fair to become of importance in the field of gas-filled mazda lamps. These 'graded' seals are not only cheaper than the ground joints, but they permit certain designs of tube that would be impossible with the ground joints.

"The use of these graded seals, capable of withstanding relatively high temperatures, suggested at once the replacement of the mercury anode used in the Heraeus quartz lamp by a solid anode.

"The solid material to be used as an anode in the quartz mercury arc lamp must have a very high melting point and a very low vapor tension. It must have a high melting point in order to withstand not only the normal temperature developed at the anode by the lamp current, but also the much higher temperature produced by the initial current, which is many times larger than the equilibrium current. The material must have a low vapor tension, because it would otherwise slowly volatilize and blacken the tube, especially in the neighborhood of the anode, a blackening which is the more serious as the light-giving section of the tube is short. Materials fulfilling these requirements were not known until recently, and among those available now, tungsten and tantalum are the best.

"The use of a solid anode has numerous advantages. Mercury vapor is now evolved only at one electrode, that is, the cathode, so that the vapor pressure for the same current and the same size mercury reservoir is greatly reduced. Of course, balancing of the vaporization of mercury at the two electrodes is no more needed since no mercury is evolved at the anode; therefore the peculiar narrow space near the cathode can be dispensed with, thereby still further reducing the vapor pressure. This means that for the same current a much smaller mercury reservoir can be used and no wings are necessary.

"The elimination of the mercury anode reservoir, the reduction of the heavy quartz tubes used in the ground joints has reduced the amount of quartz and the amount of labor necessary to shape the tube to from one-third to one-half that of the corresponding device of the Heraeus type.

"The peculiar difficulty of forcing large currents through the quartz mercury arc lamps was referred to above. This difficulty is greatly reduced in the case of the General Electric type of lamp. The volt-ampere curve has still the same characteristic, in that the volts rise very rapidly when a certain current is reached, but, with a reasonably sized mercury cathode reservoir, currents as high as six or seven amperes can be easily forced into the arc, as against the three and one-half or four amperes of the Heraeus type. Still larger currents can be obtained if wings or a small condensing chamber are provided."

Tube Efficiency

Quartz limits the permeability to ultra violet, depending upon:

1. Thickness. 2. Clarity.

According to the source of quartz, considerable differences exists in the ultra violet transmission of various specimens. For the crystalline variety, more ultra violet is absorbed when the path is parallel to the axis of the crystal than when the path is perpendicular. Pflueger, quoted by Lyman, gives the following figures for quartz one centimeter thick:

Wave length	2220	2140	2030	1860
Per cent absorbed	5.8	8	16.4	32.8

Fused quartz is ordinarily less transparent than crystal quartz; though it has been found that this effect is due to an added impurity, for there are now certain varieties of fused quartz that are quite transparent to light of much shorter wave lengths than 1850.

It may be said that the present modern form of ultra violet generating tube furnishes a spectrum that holds an ultra violet component extending as far as 1850 Angstrom units, where the limit of quartz penetration is reached.

It is generally known, and should be expected that from the standpoint of physical production the ultra violet intensity derived from mercury arc of whatever type is equal only when the energy input is identical. Coblenz says that the intensity of ultra violet emission varies practically as the square of the energy consumed in the burner. That is, if the energy input is doubled the light intensity is increased four times. This is shown in his Fig. 2.

Bohle, in his Electric Photometry and Illumination, infers that the relation between the volts and the temperature is, up to a certain point, a parallel one. In some experiments with air cooled ultra violet equipment such as is used

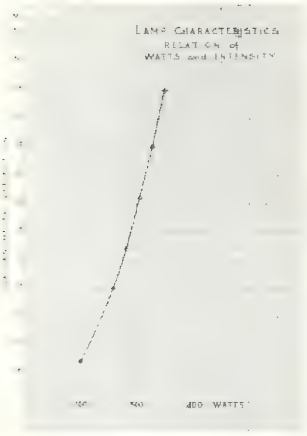


Fig. 2.

in the clinic, it has been possible to show that the temperature rises proportionately with the voltage up to a certain point. See Table I.

The effect of increasing temperature is to amplify the relative intensity of the shorter wave lengths in accordance with the displacement law of Wien (in temperature radiation, the higher the temperature the shorter the wave lengths emitted). One of the effects of the ability to withstand high temperature is the insurance of a somewhat greater intensity of short wave lengths. This can be appreciated by reference to the subjoined series of spectrograms made with an air cooled mercury vapor lamp with a tungsten mercury electrode burner shown in Fig. 3.

It will be observed that they show increasing photographic intensity of the shorter wave lengths (the bands to the right) as the voltage, and therefore the temperature, rises. From which we may infer that one of the advantages of a tube permitting the use of greater voltage through the ability to withstand higher temperature, is the insurance of a relatively more intense short wave length ultra violet output. The bearing that this has on biophysical changes will become significantly apparent when the effect of selective wave lengths is discussed.

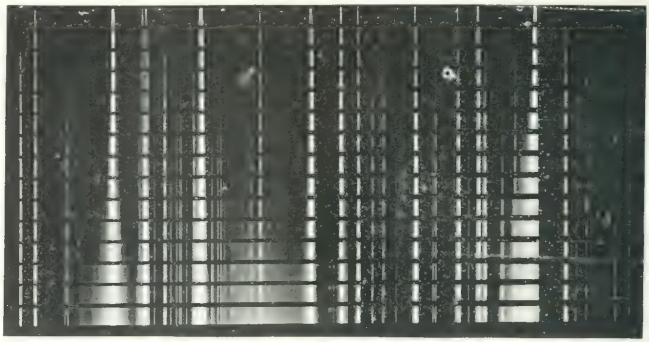


Fig. 3—Each row of spectral bands represents the spectrograms of the mercury arc air cooled lamp. The top row is 35 volts. Each successive row increases by 5 volts, so that the bottom band is at 105 volts. Each individual exposure was forty-five seconds. The distance from the spectograph slit is constant throughout. Othonon plates were used. Prepared by the courtesy of Mr. L. J. Buttolph, Cooper Hewitt Electric Co., Hoboken N. J.

TABLE I.

Temperature*—Voltage—Ampere Characteristics.

A. C. Mercury Vapor Air Cooled Lamp (Victor), with rectifier control.

SELECTIVE INTENSITY SWITCH SETTING

Time	—Low—			——Medium——			—High—		
(Minutes)	Amps.	Volts	Temp.	Amps.	Volts	Temp.	Amps.	Volts	Temp.
12.0	3.25	45	28.5	3.25	60	69	3.25	70	75
Start	7.5	5	22	9	10	20	9.75	12	19
0.5	7.5	12	22.5	9	12	21	9.5	13	19
1.0	7.25	13	23	8.75	14	22	9.5	14	21
2.0	7.24	13	24	8.5	15	24	9.0	20	23
2.5	7.0	15	27	7.5	25	26	8.5	24	27
3.0	6.5	20	28.5	6.5	30	33	7.0	34	38
3.5	6.0	25	32	6.0	40	40	6.5	40	44
4.0	5.5	25	36	5.0	45	43	5.75	48	50
4.5	5.25	28	38	5.0	48	47	4.75	50	55
5.0	5.0	32	41	4.0	52	51	4.0	58	58
5.5	4.5	34	44	4.0	55	54	4.0	60	61
6.0	4.1	36	48	3.75	55	57	3.5	65	64
6.5	4.0	39	50.5	3.5	58	59	3.25	67	66
7.0	3.8	40	51.5	3.5	59	61	3.25	68	68
7.5	3.5	41	53.5	3.5	55	63	3.25	70	69
8.0	3.5	42	56	3.25	60	64	3.0	70	71
8.5	3.5	43	57	3.25	60	65	3.0	70	72
9.0	3.5	44	59	3.25	60	67	3.0	70	72
9.5	3.5	45	60	3.25	60	68	3.0	70	72
10.0	3.5	45	61	3.25	60	68	3.0	70	73
10.5	3.5	45	61.5	3.25	60	68	3.0	70	74
11.0	3.5	45	61.5	3.25	60	69	3.0	70	74
11.5	3.5	45	62	3.25	60	69	3.0	70	74
12.0	3.5	45	62	3.25	60	69	3.0	70	74

*—Temperature determined always at one point, casing closed. These figures are valuable only for comparative purposes, showing the relation of temperature.

Effect of Water Cooling

R. W. Wood has pointed out an interesting and important operating characteristic of the mercury vapor arc at high voltage, such as is incident to the operation of the air cooled lamp. The heat development tends to volatilize some of the unused mercury in the cathode reservoir, giving rise to a film of mercury vapor that envelopes the luminescent stream. One of the effects of this mantel of mercury vapor is to diminish, by absorption, the intensity of some of the short wave lengths.

When an adequate water cooling device is added to the tube the temperature drops and therefore the voltage consumption is minimized; and the water cooling serves to condense the volatile mercury vapor surrounding the incandescent arc. The effect of the water cooling is to strip the central stream of luminosity from the absorbing mantle of mercury vapor; and this insures a maximum emission, particularly of the region 2536. This difference in intensity of the 2536 line under conditions of air and water cooling is somewhat illustrated by the accompanying comparative spectrograms. (Fig. 4.)

Fig. 4. The upper spectrogram shows the water cooled spectrum giving a great intensity of the 2536 line (heavy haloed line at right); compare with the much less intensity in the spectrum below, obtained from the same lamp improperly operated at very high voltage.

Since laboratory experiments show maximum bactericidal effect to be resident particularly in the region of 2536, it is obvious that the maximum bactericidal quality of the water cooled equipment is obtained under operating conditions that yield highest intensity of this wave length. This is obtained usually at the level of 50 volts and efficient water cooling by free water circulation.

Ultra Violet Spectrum

The complete quartz mercury arc frequency spectrum is reproduced; in this the various diagrammatic parts are accurately produced, giving above, the wave lengths in Angstrom units; and below, the frequency of oscillations per second. [2] (See Figs. 5 and 6.)

It is convenient to adopt the classification arbitrarily suggested by Luckiesh, in which that portion of the ultra violet spectrum extending from the visible violet to 3,000 Angstrom units is designated as near ultra violet; and the region extending from 3,000 to the limit of quartz transparency is designated far ultra violet.

From the general characteristics of lamp operation, as discussed above, it will be observed that the air cooled equipment furnishes a markedly intense near ultra violet spectrum; and the water cooled, in comparison, dominantly a far ultra violet spectrum characterized by a brilliant intensity of the 2536 region.

It has been known that the rays more actively bactericidal are those which have wave lengths under 3,000 Angstrom units; and the rays that produce marked erythema are longer than 3,000 Angstrom units.

By selective filtration the important ultra violet bands arranged in the order in which they produce skin reddening have been found to be as follows:

Wave Length	Minutes	Wave Length	Minutes
4000	over 30	3022	10
3907	over 30	2967	3
3821	over 30	2925	5
3752	30	2894	9
3663	27	2804	15
3650	26	2753	25
3644	26	2700	35
3391	15	2654	60
3342	14	2576	60
3126	12	2563	70

It is noticed that over a given region the biological intensity of the rays diminishes rapidly with diminishing wave lengths. By similar tests the bactericidal effect of the ultra violet energy is shown in the accompanying diagram:

Wave lengths destroying N. Y. Health Department strain of typhoid bacilli in homogeneous and counted suspension (saline) and time required.

Showing increased toxicity for various wave lengths. Distance constant throughout (100 centimeters).

Wave Length	Time	Wave Length	Time
4078	....	2804	4 min.
3907	....	2753	3 min.
3821	....	2700	3½ min.
3752	....	2654	2½ min.
3663	18 min.	2576	2 min.
3650	....	2536	40 seconds
3544	....	2482	45 seconds
3391	....	2446	40 seconds
3342	14 min.	2412	....
3126	9 min.	2378	35 seconds
3022	6 min.	....	....
2967	6 min.	2302	35 seconds
2925	5½ min.	2253	40 seconds
2894	5 min.	2225	35 seconds

From these two illustrations it is proper to conclude that, for purposes of biophysical usage, we may ascribe to near ultra violet an action which is dominantly biological as compared to the dominantly bactericidal quality of the far ultra violet.

Ritter, Herschel and Becquerel, in 1872 advocated a theory that the short wave lengths, of a great refrangibility, effect a reducing action, as opposed to the oxidizing action of the longer waves of greater refrangibility. This theory is also maintained by Draper. It is a fundamental moment for the interpretation of photochemical phenomena, though it requires very special handling in given cases as applied to some of the oxidations and reductions involved in the vital activities of the human body. Sufficient study has been directed to the difference between the effects of these rays to warrant the expression at this time that, in general, the near ultra violet (long wave lengths) is oxidizing and the far ultra violet (short wave lengths) reducing, as applied to the chemical energetics of the human organism.

Coincident with the effect of oxidation and reduction is the metabolic change induced by the ultra violet energy. Considering metabolism to be an equilibrium between the building up and the breaking down of tissue processes (anabolism and katabolism) it is possible to divide the action of ultra violet energy as exerting (1) for the near ultra violet, a synergistic effect; and (2) for the far ultra violet, a retarding effect. Rideal and Taylor in "Catalysis in Theory and Practice," point out that reactions exposed to radiant energy may either be accelerated or retarded; a chemical analogy from the inorganic laboratory of the reactions that proceed under the influence of ultra violet energy in the physiological laboratory.

From the discussion of the characteristics of the air cooled lamp and water cooled lamp, and upon a consideration of physical and clinical manifestation exhibited by each, it is possible to divide ultra violet energy for biophysical purposes as follows:

Ultra Violet
Energy
(Mercury Arc)

AIR COOLED LAMP

1. Near ultra violet intensity.
2. Biologic (dominantly).
3. Chemically oxidizing.
4. Relatively pentrating.
5. Metabolic synergist.

WATER COOLED LAMP

1. Far ultra violet intensity.
2. Bactericidal (dominantly).
3. Chemically reducing.
4. Relatively superficial.
5. Metabolic depressor.

It is understood, of course, that the subdivision is one based on efficient usage. There may arise certain indications when the application of the ultra violet would be easier through the use of the water cooled lamp than through the air cooled lamp, despite the fact that the pristine pathology is such as to require the biologic rays. In such cases, the results obtained may be gratifying, though obviously less certain than if the proper choice in lamps could be made.

Operating Constants

A number of factors are involved in the operating characteristics of the air and water cooled lamps. These are:

1. Temperature.
2. Amperage.
3. Voltage.

There is an equilibrium between the energy input and the heat output of the mercury arc; and unless this equilibrium is reached and maintained, the efficiency of lamp operation is impaired.

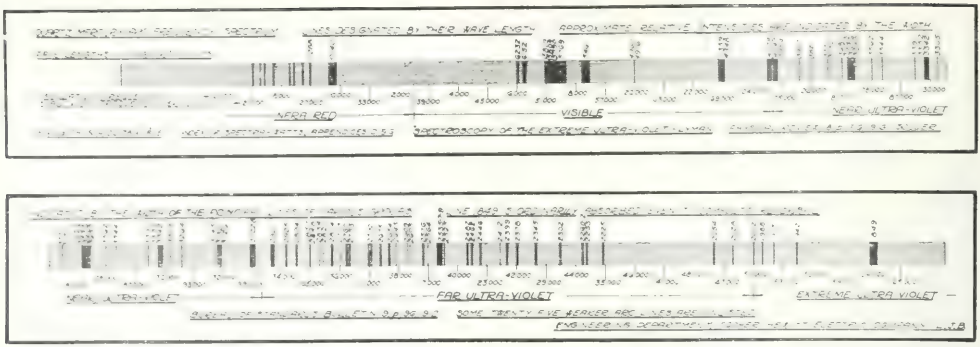
In the modern form of tungsten electrode tube, the rating is:

Air cooled tubes.....325 Watts[3]
Water cooled tubes....250 Watts

The starting conditions, while interesting, need not be considered here, because they contribute to a practical working knowledge of the tube. When operating at equilibrium, the amperage assumes a value largely dependent upon the efficiency of heat dissipation, expressed generally as cooling. As the temperature rises, the amperes fall; and, conversely, as the temperature falls, the amperes rise. So that the relation between the temperature and current (amperes) is a reciprocal one, tending to constancy. Observe that the ampere characteristic is mainly a function of temperature regulation and is quite independent of line conditions.

With the voltage, the situation is different. It depends upon—

1. Line voltage.



Figs. 5 and 6.

2. Voltage drop due to interposed resistance.
3. Amperage.

Most usually, the line voltage is in the neighborhood of 110, which is reduced by interposing a ballast resistance. And after interposing the ballast resistance, the temperature control, by its effect on the ampere control, is the next factor influencing the voltage equilibrium.

Speaking now from the viewpoint of clinical efficiency, we may summarize the conditions, and their reasons, that the air and water cooled lamps best operate under:

	Air Cooled	Water Cooled
Amperes . . .	3.25 to 4.50	4.5 to 6.5
Volts	90 to 70	60 to 40
Regulation	Resistance	Resistance and Water Cooling

Operated under these conditions, there is insured a maximum useful life for the tube; a maximum efficiency of spectral quality for clinical purposes; a greater degree of manipulative satisfaction in eliminating interfering influences such as arise when the tubes are operated on other than their characteristic equilibrium.

Clinical Ineffectiveness of Tube Depreciation

It is a current opinion that the intensity of quartz mercury vapor arc radiation, more especially the ultra violet component, issuing from quartz mercury vapor lamps, greatly decreases with usage; a factor that challenges the life-efficiency of ultra violet tubes.

In the tungsten electrode tube the factors that enter into the deterioration of the emissive qualities may be grouped into two sets; first, the deposit of electrode products (vaporized tungsten) on the walls of the tube; and, secondly, divitrification of the quartz wall.

Both of these are virtually functions of the temperature characteristic of the tube.

In the case of the water cooled tube, which should be operated at low-temperature-voltage characteristics, both the tungsten vaporization and the quartz divitrification are always at a minimum; so that the intensity emission of the water cooled type of burner remains efficient for practically the entire period of tube existence.

Modern practice shows a growing tendency to adopt the clinical classification of air cooled and water cooled lamps, as, respectively, biologic and bactericidal energies; the air cooled lamp representing the near ultra violet intensity of long wave lengths, as compared to the short wave lengths for far ultra violet intensity of the water cooled lamp.

The quartz transmission of ultra violet is determined by the absence of enclosed or deposited impurities. Divitrification and tungsten vapor deposit are, effectively, enclosed and deposited changes. It is well known that as a material becomes increasingly opaque to ultra violet energy, the opacity begins first with the shorter wave lengths, and gradually extends to the longer wave lengths. For reasons that have elsewhere above been discussed, the extremely short wave lengths generated in the air cooled burner, are not completely transmitted. The transmsision is hindered by a veil of mercury vapor which is formed around the luminescent arc as the result of the volatilization of part of the unused mercury in the cathode reservoir. Deposits of tungsten vapor on the interior of the tube surface are generally localized to the immediate radial vicinity of the tungsten anode, and in this limited localization the tungsten deposit, even if accumulated in liberal quantity, is effective only in obstructing the shorter wave lengths; so that the biologic intensity included in the wave lengths longer than 2,700 Angstrom units has not been found to be appreciably decreased or effectively impaired, clinically, during the life-course of the tube.

From the viewpoint of the clinician, the physical laboratory reports of the decrease in ultra violet radiation with usage of quartz mercury vapor lamps are beyond the practical standards set by commonly adopted medical uses; and it may be fairly said that, employed in the manner recommended as being more efficient, the intensity emission characteristics of the air cooled and water cooled burners remain virtually unimpaired, or are impaired so slightly as to make the tubes useful for practically their entire life.

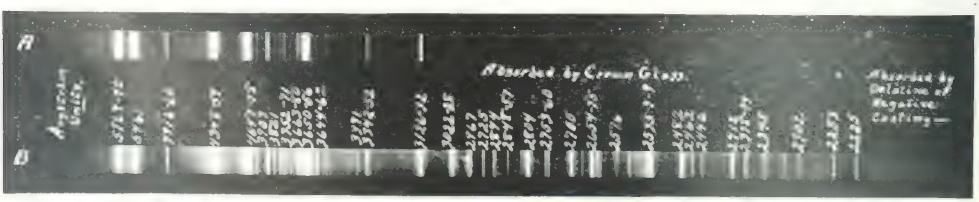


Fig. 7.

FOOTNOTES

1. The material for the discussion of the Heraeus type of burner is taken mainly from the article "The Quartz Mercury Lamp," by Dr. E. Weintraub. This appeared in the General Electric Review for the year 1914, page 270.

2. This frequency spectrum, together with the prisim spectrum has been courteously loaned by Cooper Hewitt Electric Company. kindness of Dr. Mailey and Mr. Buttolph. I am indebted to the same source also for the prismatic spectographs taken in various voltages and for a prismatic spectrogram showing the glass and quartz transmission.

3. A watt is the product of an ampere times a volt.

An Apparatus for the Purification of Radium Emanation

C. F. WHITTEMORE, M. S.
Denver, Colorado

AN apparatus for collecting and purifying radium emanation recently installed at the Rutherford Hospital, Rutherfordton, North Carolina embodies several new features of design which may be of interest to others who use radium. The general principle of the method employed for purification of the gas is the same as that used by Debeirne and others in their early research and later used by Duane in his apparatus at the Huntington Hospital in Boston. In designing the equipment described and illustrated in this publication, the writer has adopted the plan of mounting two complete units on a metal frame as in the Failla installation at the Memorial Hospital, New York City, but the design differs in many respects.

The manifest advantage of using the much more compact tubes of radium emanation instead of radium itself has been discussed so often it requires no further comment here, but it may be advisable to refer to the advantage of the Duane type of apparatus over other forms of equipment. This advantage lies chiefly in the fact that liquid air is not required. A great many millicuries of the emanation may be purified and collected in extremely small tubes having a volume less than one cubic millimeter, and the apparatus may be used daily for long periods without replacement of parts.

A diagram of the glass parts shown in Fig. 1 is not a working drawing, but is intended simply to illustrate the essential features. The radium is placed in a slightly acid solution in a flask (1) which is surrounded by other protecting vessels and enclosed in a wall safe through which a glass tube (2) extends and connects with the first bulb (3) of the apparatus. The radium emanation is a gas which could readily be collected if it were not for the fact that the water of the solution is decomposed into hydrogen and oxygen by the radium rays. The emanation, which is extremely small in volume (1,000 millicuries amounting to only approximately six-tenths of one cubic millimeter) is therefore mixed with relatively large volumes of hydrogren and oxygen. These gases accumulate in the flask (1) after all air has been pumped from the entire apparatus. Diffusion of the mixed gases through tube (2) into bulb (3) is effected when the mercury is lowered below the junction of the connecting tubes at (4). Owing to their pressure the gases begin to enter the bulb (3) before the mercury is completely lowered. A by-pass (5) is therefore provided here to prevent the violent bumping which would occur if the gases were required to enter bulb (3) from directly below the large quantity of mercury. There is no appreciable disturbance when the gases bubble through the side tube or by-pass.

The radium emanation and extraneous gases are next forced through the mercury trap (6) into the purifying chambers (7), (8) and (9) by opening stopcock (10) and permitting air at atmospheric pressure to enter reservoir (11). The mercury consequently rises in bulb (13) until all the gases contained therein have been carried before it into the purification chambers. This pumping operation is repeated until practically all of the emanation has been drawn from the flask. Generally three operations suffice. The mercury is allowed to rise only a short distance above the capillary trap (6) and it automatically stops before entering the chambers which are placed well above barometric height. The glass tube (7) contains the usual oxidized copper wire in the form of a spiral around a quartz rod supported at each end to prevent the hot wire coming in contact with the glass walls. When heated to redness by means of an electric current varying from two to ten amperes the hydrogen and oxygen combine and the resulting water is absorbed by phosphorous pentoxide in tube (8). There is an excess of hydrogen above the amount required to form water by combination with the oxygen present, hence the necessity of a small amount of copper oxide which eliminates the remaining hydrogen. This excess of hydrogen is attributed to the formation of hydrogen peroxide whereby some of the oxygen is retained in the radium solution. The potassium hydroxide in tube (9) eliminates any carbon dioxide, leaving the small volume of radium emanation free from impurities, except helium, which is present in a volume slightly greater than that of the emanation itself. The total volume of the purified radium emanation and the helium is so very small, however, no further treatment to remove the helium is necessary.

The Lind type of coil in which a platinum wire carries the electric current to heat the copper-oxide has not been used in this apparatus because the writer's experience has shown that the simple oxidized copper coil is entirely satisfactory, lasting for more than a year, and in one instance, for fully fifteen months with collections as a rule three times each week. Whenever replacements eventually become necessary it is a convenience to have but one glass tube connection as illustrated in Fig. 1. The coil is placed above the chemical chambers on a separate tube instead of in the direct line, which would require two connecting tubes with consequently greater difficulty in replacement. The coil shown herein may be readily detached by cutting the single connecting tube and the new part sealed on in one operation. Offsetting the coil from the main line in this manner does not impair the efficiency of the apparatus judging from the consistently high recoveries of purified emanation.

The removal of the emanation from the purification chambers is accomplished by bulbs (12 and 13) which constitute essentially another Toepler pump similar to the parts (3 and 11) employed in bringing the gases into the apparatus from the radium flask. During the purification process, the mercury has remained in bulb (12) and tube (14). It is now lowered by pumping the air from reservoir (13), opening stopcock (15) to permit the flow from bulb (12) to (13). The junction (16) of the connecting tubing is thereby unsealed and the purified emanation diffuses into (12). Air entering reservoir (13) through the three-way cock (17) forces the mercury to rise again in (12) and the emanation is carried past the cock (18) which is then closed. Mercury has been allowed to stand in the U-tube (19) in order to prevent the passage of the gas into the tube (20) and to direct it into the fine capillary tube (21) which is the final container. Air is then allowed to enter reservoir (22) the mercury flowing through open stopcock (23) to U-tube (19) and into the capillary (21), where the emanation is finally collected. A small gas flame is used to fuse this tube and remove that portion containing the emanation.

This part (19) of the apparatus has been placed as far as possible toward the side in order to make room for the long capillary tube, which extends across the machine. In this manner it has been possible to eliminate the undesirable extension of the capillary beyond the supporting frame of the apparatus. The capillary is supported by wire hooks suspended from a rod which is rigidly attached to the heavy metal frame. A mercury-sealed three-way stop-cock (24) facilitates the connection of either unit with the vacuum pump.

Metal tubing for the frame of the apparatus possesses several advantages over the customary angle-iron supports. Its superiority lies chiefly in its greater rigidity. In this installation all electric wires have been concealed within the hollow tubing, thereby eliminating the usual unsightly separate conduits, or open-wiring. Wherever wires extend through the frame, as for example, near the copper coils and back of the switchboard, standard porcelain condulets are threaded directly into the tubing.

All electrical controls are assembled on one switchboard within easy reach from either side of the apparatus. A small pilot lamp at the top of the switch panel is lighted while the current is passing through the coils and serves to remind the operator to switch off the current before leaving the laboratory.

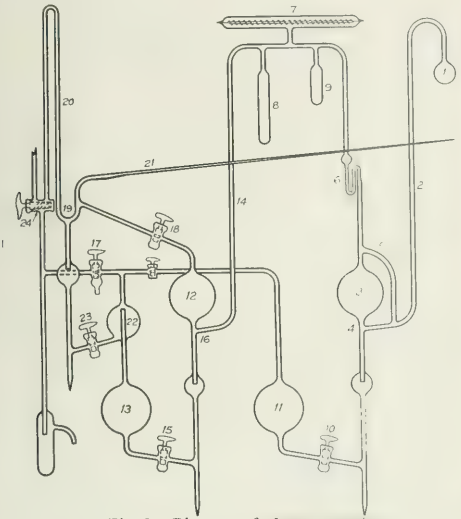


Fig. 1—Diagram of glass apparatus.

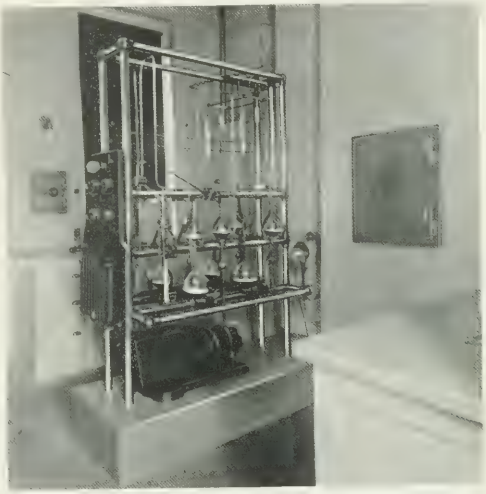


Fig. 3.—General view of radium emanation laboratory.

A "battery-charging" type of rheostat completes the switchboard equipment.

Another feature of this design is the method of supporting the mercury-sealed stop-cocks. In the opinion of the author most of the breakage of stop-cocks on apparatus mounted on metal frames has been due to insufficient support. Generally no provision whatsoever has been made to attach the stop-cocks to the frame. In this installation a metal plate is fastened to the frame, just back of each cock, which is then bound to the plate by metal bands on each side. Thick felt packing around the glass tubing between the bands and plate serves to hold the stop-cock very securely, yet without exerting any strain upon the connecting parts.

A two-stage oil-sealed rotary vacuum pump is used both for exhausting the air from the entire apparatus and for manipulating the mercury pumps. The rotary pump is operated by a one-half horsepower electric motor mounted upon the same base as regularly furnished by the General Electric Company. The author has employed the same type of pump, in conjunction with a Langmuir mercury vapor condensation pump, in another installation for over three years, and found it most satisfactory for this service. The Langmuir pump is often a convenience for general laboratory purposes, but entirely unnecessary in connection with the radium emanation apparatus and has not been included in later installations.

A near view of the complete apparatus is shown in Figure 2 and a more comprehensive view of the entire radium laboratory at the Rutherford Hospital in Figure 3.

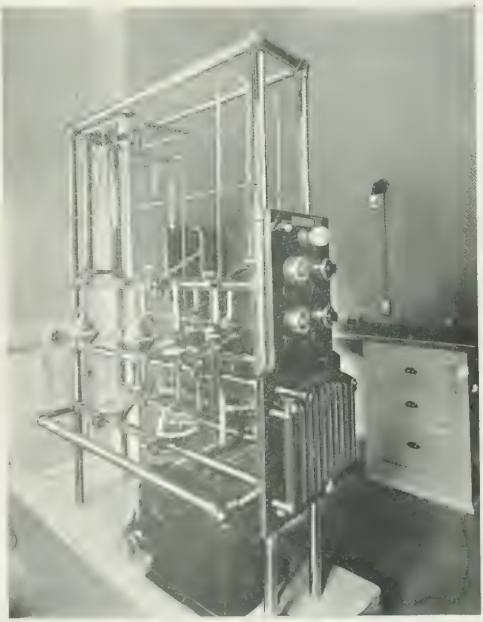


Fig. 2—Complette apparatus showing glass parts, vacuum pumps and electrical connections.

EDITORIAL

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A Journal of ideas and ideals

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ANNUAL MEETING

Hotel Statler, Detroit, Michigan

December 4, 5, 6, 7, 8, 1922

A Review of American Radiology

IT HAS BEEN a long and eventful journey from the ten-inch coil to the twenty-inch transformer, from the three-inch Crookes tube to the thirty-inch Coolidge tube. But that has been the price paid by American radiologists, many of whom are still living to bear witness concerning the pleasures and the pains encountered while traveling the rugged road of development which has characterized the growth of the science of radiology.

In this respect, the science of radiology is perhaps no different than any other science. Humankind is always prone to belittle the accomplishments of contemporary workers in the scientific field. However, as the passage of the years affords a new perspective, and the cumulative results of a given scientific achievement appear, skepticism is too frequently supplanted by credulity; and it often becomes necessary to provide impartial methods for viewing the attainments achieved in a particular branch of science, so that their relation to the whole scientific field involved may be correctly valued, and a reasonable estimate of their potential possibilities fixed.

That is why it seems wise at this juncture to review the enormous developments actually accomplished in the science of radiology in the last 27 years—which, by the way, are the first 27 years of its existence. Notwithstanding this apparent newness, there can hardly be any question that sufficient time has elapsed to furnish a substantial background against which to trace the trend of the science in its relation to the public health generally, and to all medical science specifically.

By cataloging the recognized achievements of some of the conspicuous characters contributing to the science, it ought to be possible to get a fairly definite and comprehensive picture both of the present utilitiy of the science of radiology and its future possibilities.

Such a review will, of course, have to do very largely with the formative period of the science. That is the reason why it is so important to chart its course. Particularly is this so since the science of radiology is now emerging into a broader and more responsible sphere of activity. And the suggestion can hardly be otherwise than well taken, that in the attainments of the outstanding men who have builded the science to its present degree of utility, will be found certain indications pointing the way to present and future effort.

Brief recital of the accomplishments of the men who are responsible for the present high state of radiology, will unquestionably warrant the conclusion that the science of radiology is the supreme composite conception of the biggest and best brains in all branches of medicine. This thought is not stated with any desire to pat the radiologist on the back, by implying that he is a specially endowed member of the medical profession. Rather, it is stated for the purpose of directing attention to an indisputable fact, a fact which, stated in a few words, means that the radiologist travels a dangerously precipitous path, for that it runs along the crest of all medical science and deals with both negative and positive formulas. In short, the radiologist is charged with the responsibility of providing certainty in diagnosis and precision in treatment; and the man or woman who approaches the science, either as a contemplating practitioner or as a user thereof for diagnostic and therapeutic purposes as an aid in his work, with the thought that it is but a highly specialized branch of photography, is bound to come to disaster as an individual and in results obtained.

Any man who will measure the achievements of the outstanding figures in radiology with a fair degree of conscience will recognize that whatever attainments have been gained, have been gained by sheer scientific effort, a superhuman devotion, and an incomparable faith in the value of radiant energy diagnostically and therapeutically applied.

Early Martyrs

These columns have chronicled the demise of several men who have been martyrs to the cause of American radiology, men who have paid the supreme sacrifice that those of the younger professional generation might profit by their experience and "carry on" without the pain and suffering and death which they suffered. To mention the names of Dr. Eugene W. Caldwell, Dr. Walter Dodds, Dr. Heber Robarts and Dr. John Nesbit Scott, is to utter a prayer of thanksgiving that men of such sterling character were given to the great body of American physicians and radiologists—a prayer that those of us who assume to pick up their labors may profit by their experience and may prove worthy to be called followers in their footsteps.

All of these men were charter members of the American Roentgen Ray Society and did much to organize and lay proper foundation for what has developed into one of the great roentgen ray societies. Dr. Robarts, who but lately dropped his mantel on the shoulders of lesser radiologists as he ascended in a chariot of fire, was the founder of the American Journal of Roentgenology. The first meeting of the American Roentgen Ray Society was held in his office. He was elected its first president. It will be recalled that he was not only active in this society, but was also active in The Radiological Society of North America; and upon him and Dr. John Nesbit Scott the honorary degree was conferred by the latter in 1919.

To Dr. Walter Dodds is due the credit of organizing the x-ray department of Massachusetts General Hospital. The value of this institution in leading the radiologists of America to better things is immeasurable. To him is also due the honor of developing the so-called "Dodds Formula" which has relieved the suffering of many patients and has be-

come a household remedy for the treatment of x-ray dematitis by American radiologists.

Dr. Dodds was one of the earliest pioneers in American radiology. His experiments had been carried on long enough that in 1896 he suffered his first operation for the relief of x-ray dermatitis. Following this, up to the time of his death in 1918, he submitted to fifty operations. In spite of his physical condition, he volunteered his services to his native country, England, very soon after that country entered the war. The sacrifice which he paid can best be appreciated by the knowledge that the exposure to x-rays incident to army service set on fire the old trouble and soon took his life in payment.

. Dr. Caldwell might be called the "chief corner stone" of the profession of radiology in America. His education as an electrical engineer provided a knowledge possessed by few medical men. Dr. Caldwell used this knowledge to wonderful advantage in improving apparatus and devising new equipment. His valve tube, his stereoscopic fluoroscopic table and his early work on x-ray diagnosis of diseases of the nasal accessory sinuses, were original and valuable.

Early Pioneers

Among the ealry pioneers in American radiology one naturally thinks of Dr. Francis Williams, who was the first to employ the x-ray for therapeutic and diagnostic purposes in America. He wrote the first American textbook on x-ray therapeutics. He still lives to breathe his beneficent inspiration into the younger generation of American radiologists. At the Boston meeting of the American Radium Society, held in 1921, Dr. Williams was present, and was made an honorary member of that organization in recognition of his contributions to the science of radiology. He was the first American physician to employ radium therapeutically. Although time has whitened his hair, he still stands head and shoulders above the great majority.

Dr. George H. Stover of Denver began his professional career in the days of the three-inch Crookes tube and continued actively in the science until his death in 1915. During his life he was a member of the American Roentgen Ray Society and contributed frequently to the Journal of Roentgenology as well as to general medical literature. His studious industry and broad vision advanced radiology materially.

Early Teachers

American radiology owes a great debt to the physiologist, Dr. W. B. Canon, who was the first to employ the salts of heavy metals in the study of the gastro-intestinal tract. It will be recalled that he was compelled, by the lack of power in the apparatus available at that time, to use geese and cats for his experiments. By employing animals with thin bodies he was able to get quite clear fluoroscopic and radiographic images. On the foundation laid by Dr. Canon has been built the whole superstructure of gastro-intestinal examination of today. The published report of this early work appeared in the American Journal of Physiology, 1901-2, page 251. Since that date much has been contributed by this eminent physiologist toward the solution of those problems which the radiologist meets in actual practice every day.

Dr. Charles R. Bardeen, Dean of the Medical School, University of Wisconsin, and Professor of Anatomy in the same institution, has done more than any other American anatomist to render the study of anatomy a clinical subject by employing radiology in teaching it. His study of the development of the carpal bones stands out as a vivid illustration of the value of this method of teaching. His study of the heart by fluoroscopic observation and radiographs has been of inestimable value to the medical profession in general and the specialty of radiology in particular.

It will be recalled that the work of the late Dr. James G. Van Zwaluwenburg was done at the University of Michigan. Although only fairly started in this important work at the time of his death, he contributed largely to the advance of American radiology. His work on the employment of pneumoperitoneum in gynecological examinations was a distinct contribution to the subject. His term "pelycography", coined to describe this kind of examination, is descriptive and useful. Much other work was under way and American radiology lost much in his death. It is indeed fitting that his mantel has fallen on so able a successor as Dr. Preston M. Hickey, whose ripe clinical experience should enable him to go on with the work so ably begun by his predecessor.

Early Clinicians

By those who have followed the development of American radiology it will be remembered that in the early period there grew up what might be called two schools of diagnosis. The one branch held that plates were the only satisfactory method for making gastro-intestinal examinations, and the other branch contended that plates were unnecessary, since all the information could be gained by fluoroscopic examination alone. It is a happy moment which now makes it possible to say that these extreme views are no longer held. There are several living radiologists who took an active part in the controversy when it was at its height. Perhaps the most outstanding follower of the plate method of gastro-intestinal diagnosis is Dr. Lewis Gregory Cole. He brought the method to a state of perfection attained by none other on this continent. To follow his careful diagnosis to the operating table and see such a high percentage of diagnoses proven correct is to be impressed with the accuracy and ability of this master diagnostician. His frequent contributions to medical literature have justly clarified the problems of gastro-intestinal diagnosis.

Of the men who might be termed followers of the fluoroscopic method, Dr. R. D. Carman is a conspicuous example. It will be accepted without argument that his accuracy as a diagnostician in gastro-intestinal lesions ranks high. Practically half his time is spent in the surgical operating room studying the pathology which he has previously visualized under the fluoroscope. Can any one suggest a more profitable method of connecting the x-ray examination with actual pathology?

Early Physicists

This discussion would not be complete if the name of Mr. Clyde Snook, electrical engineer and physicist were omitted. Mr. Snook was the inventor of the so-called "Interrupterless Transformer." This type of apparatus has superceded all others in America and is rapidly being adopted in other countries. This invention made possible a rapid advance in radiology.

Mr. W. D. Coolidge, Ph. D., solved the problem of the hot cathode tube and made this solution practical in the Coolidge Tube. This invention, combined with the interrupterless type of transformer, is responsible for the present high state of radiology. The Coolidge tube is primarily the foundation of the present deep therapy technique. The Coolidge tube rendered practical the self-rectifying type of x-ray unit. In fact, to think of modern radiology is to think of Coolidge. He is an honorary member of both the American Roentgen Ray Society and The Radiololgical Society of North America.

Early in the development of American radiology Professor J. S. Shearer, Ph. D., became interested in the physical problems of the science. To his untiring efforts are due the solution of many problems, such as the most effective voltage for radiography, the action of different qualities of x-rays on silver emulsions, the effect of different thicknesses

of filters on x-rays, etc. Early in the war he was made Chief Consulting Physicist to the X-ray Department of the United States Army. He was placed in charge of a school of instruction for medical men entering the x-ray service of the army. He was chairman of the committee on x-ray protection appointed by the American Roentgen Ray Society. His untimely death cut short a highly valuable work when only well begun.

Professor William Duane, Ph. D., has attacked the physical problems of x-ray and radium with characteristic aggression and vision. To his untiring effort may be attributed the solution of many of the physical problems involved in the present deep x-ray therapy. Dr. Duane is now applying the purely physical knowledge which he has gained to the actual treatment of patients, and some wonderful material should result from his work, because he is bound to get a better idea of the clinical effect of various forms and intensities of radiation by this method. His work in radium research has become especially well known, and to him is accorded the honor of inventing an apparatus for collecting the emanations given off by radium.

The Writing on the Wall

Brief mention has been made of some of the men who have blazed the trail leading to the present state of radiology in America. It will be noticed that medical clinicians, physiologists, electrical engineers, physicists, anatomists, teachers, and radiologists have all contributed to the science. The list of those who have added materially to the wealth of data and scientific findings which is now the common property of radiologists is a long one. If it were possible to do so here, there would be considerable pleasure derived from the compilation of a complete list of such men as Dr. Emil G. Beck, who was the first to use the stereoscopic method in x-ray examination; and who, though a surgeon, has contributed prodigiously to radiological literature.

The fact which must be recognized as unequivocal is, that all branches of medicine and the allied sciences have had an important part in the formation and development of the science of radiology. It is but natural, therefore, that radiology should be called upon for aid in diagnosis and treatment in a wide range of cases and subjects.

Some idea of the extensive use made of radiology at the present time may be gained by examination of the annual reports of various hospitals. In the larger institutions, approximately 80 per cent to 90 per cent of the total number of patients hospitalized pass through the electro-therapeutic department. Electro-therapy seems to be more extensively employed in America than in other countries. This is demonstrated by comparison of American statistics with those of institutions in England, for example, which undoubtedly ranks well in the forefront in radiological activities. The report of the Manchester Royal Infirmary for 1920 shows 11,550 admittances. Of these 9,203, or slightly more than 71 per cent, passed through the x-ray, electrical and massage departments.

Facing the record squarely, it is impossible to refute two conclusions: (1) that radiology as a science actually makes closer and more intimate contact with all phases of medical practice than does any other specialty of medicine; and (2) that in order to practice his science conscientiously and successfully, the radiologist must not only be well grounded in the fundamentals of, but always keep fresh on the latest authentic knowledge concerning, the numerous aspects of medicine, both preventively and curatively.

No other specialty in medicine is so far-reaching or exacting in its requirements. Dr. S. B. Childs is the author of the statement that "The radiologist must be a good internist, and add to that his knowledge of radiology." But even so comprehensive a statement does not seem sufficiently broad or inclusive enough to scope the actual fact.

It seems clear that the radiologist who hopes to hold the confidence of the medical profession, as well as the public to which he ministers, must at his peril, display at all times an accurate and personal knowledge of all phases of medical science. He must know anatomy, physiology, pathology, and so on through the whole category, so that he can at all times give unmistakable evidence of the fact that he is a masterly combination of clinician, internist, and radiologist. Nothing but grief can attend the dabblings of that man or woman afflicted with dilettanteism who chooses the science of radiology for a profession under the misapprehension that it affords an easy way to an affluent existence.

There is plenty of evidence on every hand to show that radiology is being looked upon with increasing respect. Indicative of this trend is the striking illustration found in the recent action of the Mayo Clinic, at Rochester, Minn., where, according to information just received, a most complete and fully equipped electro-therapeutic department has lately been installed. That institution has, of course, used the x-ray extensively for diagnostic and therapeutic purposes for a good many years, and has also employed radium therapeutically in a great number of cases. But the electro-therapeutic department has been quite materially enlarged by the addition of many devices, including in this the ultra-violet. This fact is especially significant when it is remembered that the Mayo Clinic has always been primarily a surgical institution.

In order to guard against the false assumption that radiology as a science has become so thoroughly entrenched that no further effort at development is necessary, attention is directed to the axiomatic rule of conduct that before a man can command public respect he must first have developed in himself a high degree of self-respect. This applies to the radiologist as much as anybody else. And it is cited here for the purpose of bringing to radiologists everywhere an appreciation of the responsibilities falling on them as individuals, the result of the attainments of men like those alluded to in earlier paragraphs.

So much remains to be done in an investigative way for the scientific determination of a plethora of chaotic conditions that failure can only be accepted as incontestible proof of an absence of that degree of self-respect which justifies public confidence. Quite naturally, this involves an extravagant expenditure of energy and time in the study of all phases of medical science in their relation to the science of radiology, as it also involves an intensity of devotion to the science of radiology which excludes for once and all, all useless indirection and wobbly pussyfooting. This is the standard fixed by the men mentioned as the builders of the science.

A wonderful opportunity, surrounded by every imaginable fortuitous circumstance, is within the reach of American radiologists. That they will arise, seize it, and make it their own for the advancement of all medical science and the benefit of the public, does not at the moment appear open to question. Too much has already been achieved to permit the intervention of such a catastrophe by the witting failure of the large body of American radiologists, struggling forward to the limit of their capacity under the wise counsel and painstaking assistance of men of unimpeachable reputation in all phases of medical and the allied sciences.

American Registry of Radiological Technicians

AT the present time the main purpose of the board appointed to conduct this registry is to foster the organization according to the rules and regulations laid down and adopted by The Radiological Society of North America. Sufficient machinery has already been established to begin

the registration of applicants. A good-sized number of applications are already on file. The necessary investigation of credentials and the arrangements for examination are being made.

This actual consummation of plans long studied and carefully arranged has stimulated other societies to see the need of some board to register radiological and radium technicians. We understand that the Canadian Radiological Society has named a delegate for this Board, though official action has not yet been received. Invitations have been sent to the American Roentgen Ray Society and to the American Radium Society to do likewise.

It is understood that some changes will have to be made in the plans now adopted if a larger representation is included. Should the Board undertake the registration of radium technicians special consideration must be given to their workers in accordance with the highest ideals of the radium workers.

Since the announcement of the plans for the registry some comments have been seen and some criticisms have been received by the Board. For instance, the trade journal, "Radium Therapist," published by the Radium Company of Colorado, in its July and August issues very kindly calls attention to the registry. They speak highly of the action of the Radiological Society in establishing such a board. But they regret that the lines were not drawn broad enough to include radium helpers. This conclusion is hasty. As in the organization of the Radiological Society of North America, so in the Registry the term "radiology" and all its various uses was especially adopted so that eventually all workers using any form of radiant energy might be included eventually. At present it requires only slight modification of the procedure to include radium technicians. Diplomatic negotiations with other societies may enlarge the Registry so that the radium technicians may be cared for by the same board. The American Radium Society has received an invitation to join in the conduct of the Registry.

A few well-meaning radiologists have written the Board, evidently with the idea in mind that the establishment of the Board is now under discussion, and have entered into lengthy argument for and against the principles involved. This is entirely beside the point. The matter of establishing a board was carefully studied over a period of years. There was no disagreement on the part of the various committees that a board is feasible and highly desirable, if the large army of technicians employed in our laboratories is to maintain a high standard or to be controlled.

The following excerpt from a letter recently received from one of our leading radiologists not only illustrates this point, but also refutes the very argument he advances against the recognition of technicians.

"To come to the point bluntly and unequivocally, I am out of sympathy with the entire project of the training of x-ray technicians as outlined in your letter. My reasons for being opposed to the training of technicians are briefly as follows: In the first place, I think it is a fundamental error for a roentgenologist to delegate the technical side of his work to subordinates. Necessarily, I, in common with many other busy roentgenologists, have to do this, but my view is that the roentgenologist should do his own technical work."

The answer to this is that he can not do his own technical work, because he does not have time, and therefore the trained technician is a necessity.

The Registry is an established fact, and until The Radiological Society of North America disowns its child it will continue to grow into maturity claiming parental care and recognition. From the present state of the infant's health it seems to have a promising future which will be limited only by the time and foresight of those directly interested.

EDWARD W. ROWE.

Roentgen Society Notes

SIR HUMPHREY ROLLESTON, President of the Royal Society of Physicians and Past President of the Royal Society of Medicine, has just been elected President of the Roentgen Society. As Chairman of the X-ray and Radium Protection Committee he has already rendered distinguished service in this field. Under his leadership the Society is looking forward to a very interesting year, which will mark the close of the first quarter century of its existence.

Sir Alfred Pierce Gould, one of the earliest workers in the field of radium, and a Past President of the Roentgen Society, died April 20th at Ashburton, England. He had just completed seventy years of a long and useful life, during which he distinguished himself not only as a surgeon, but as a preeminent worker in cancer research.

Rail Fares Annual Meeting

REDUCED railroad fares of one and one-half rate for attendants and adult dependents have been secured for the Annual Meeting, to be held in Detroit, December 4th to 8th.

These rates are applicable in the territory under the supervision of the following Passenger Associations:

Western Passenger Association, all lines, including New Mexico.

Canadian Passenger Association, eastern lines only.

Central Passenger Association, all lines.

Transcontinental Passenger Association, applies in all territory except "from Portland or points south through California," and "from California or Nevada." The Chairman of the Transcontinental Association states that "those traveling from California, Nevada, and from Portland and points south through California, may avail themselves of tourist fares in effect daily to Detroit, Michigan, and return of $161.92 from San Francisco, Los Angeles and San Diego.

Southwestern Passenger Association, all lines.

New England Passenger Association, all lines.

Southeastern Passenger Association, all lines.

Trunk Line Passenger Association—rates will apply in New York state (east of Buffalo and Salamanca), New Jersey, Pennsylvania (east of Erie, Oil City and Pittsburgh) Delaware, Maryland, District of Columbia, Virginia and West Virginia (east of Wheeling, Parkersburg and Kenova).

In territory west of Port Arthur and Armstrong, Canada, under the supervision of the Canadian Passenger Association, Western Lines, no reduction in fares will apply.

The tariff conditions governing the rates in question are:

1. Minimum fare of $1.00.
2. Identification certificate must be presented to railroad agent at point of origin, which will entitle the holder to purchase round trip ticket or tickets for himself and dependent members of his family to detroit and return.
3. Selling dates, November 30th to December 6th.
4. Validation dates at Detroit, December 4th to 14th.
5. Tickets good leaving Detroit any day within final limit with the restriction that the final trip must be completed by midnight of December 14th.
6. Tickets must be used returning over the same route as going.

The identification certificate called for in the tariffs will be furnished through the Business Office in ample time, and all confusion incident to validation, such as characterized the Annual Meeting last year, will be avoided.

Attention is called to the fact that the identification certificate plan under which tickets will be purchased this year, is an entirely different plan than the certificate plan which obtained last year.

If, for any reason, any person contemplating attendance, and who is entitled to identification certificate fails to receive it by the middle of November, he should get in communication with the Business Office of the Society at Omaha as promptly as possible.

Canadian Radiological Society

THE Third Annual Convention of the Canadian Radiological Society was held in Winnipeg, Canada, in conjunction with the Dominion Medical Association June 20-23rd, 1922. The Scientific Session lasted for three days, and included a series of extremely interesting communications. We had the honor to have present with us and contributing to our programme. Doctors Lewis Gregory Cole, Russell D. Carman, B. H. Orndoff, R. H. Stevens, F. S. Bissell, and C. J. Sutherland.

The officers elected for the coming year are: President, Dr. L. J. Carter, Brandon; First Vice President, Dr. C. W. Prowd, Vancouver; Second Vice President, Dr. J. C. McMillan, Winnipeg; Third Vice President, Dr. L. T. Pariseau, Montreal; Secretary-Treasurer, Dr. L. K. Poyntz, Victoria. The Executive Committee is composed of Dr. G. E. Richards, Toronto; Dr. A. E. Walkey, Hamilton, and Dr. L. K. Poyntz, Victoria.

The rules and regulations governing the Canadian Registry of Technicians established in 1921 were adopted, and Dr. L. K. Poyntz was appointed Registrar and Examiner.

L. K. POYNTZ.

New Officers of Western Society

AT the meetings of the Western Section and Pacific Coast Roentgen Ray Society, at Yosemite, May 15th, new officers of both organizations were elected, as follows:

WESTERN SECTION

M. P. Burnham, Chairman.....San Francisco
F. C. Swearingen, Vice-Chairman.....Pomona
Roy Payne, Secretary.....Portland

PACIFIC COAST SOCIETY

Raymond G. Taylor, President.....Los Angeles
Chas. M. Richards, Vice-President.....San Jose

As Chairman of the Western Section, Dr. Burnham will serve on the Executive Council at the Los Angeles meeting.

DEPARTMENT of TECHNIQUE

Technique for Cleaning Non-Washable, Non-Cleanable Intensifying Screens

GEO. M. LANDAU, M.D.
Cincinnati, Ohio

THE following process is carried out in the preparation of non-cleanable, non-washable screens:

1—Wash screen with ivory soap and warm water, using pledget of cotton as sponge.

2—Rinse well and repeat above.

3—Saturate pledget of cotton with alcohol and rub over screen surface lightly.

4—Dry screen and apply a coat of ordinary canning paraffin (softened only by the heat of the hand) by means of passing entire surface of paraffin cake over screen surface. Apply in one direction only. After screen surface is entirely covered, rub wax in thoroughly by means of cheese cloth, changing the rubbing surface of the cloth frequently. Apply a second coat of wax, and repeat above procedure. The paraffin now affords a protection to the screen against dark room solutions and dust particles cannot be imbeded in the screen surface proper.

To clean the screen only a pledget of cotton saturated in alcohol is necessary to remove the coating of paraffin, and with it the dust particles, etc., which have collected on the surface. This will leave the surface of the screen free from imbedded foreign particles, and it will be necessary only to rewax the screen. As a rule the screen need not be washed with soap and water again unless exceptionally dirty. Screens having been prepared by this technique three years ago are still doing service. To new screens only a coat of paraffin was applied. As to the effect on the speed of the screen, I am unable to notice any perceptible difference.

NEW EQUIPMENT

Hanovia Deep Ray Lamp

THE accompanying illustrations of the Hanovia Deep Ray Lamp suggest an unique piece of apparatus for those using electrotherapeutic devices. It will be observed that the mechanism of this lamp is so adaptable as to meet almost any immediate requirement in positioning.

With the present marked interest in, and increasing use of, electrotherapy, considerable attention is being paid by the medical profession to equipment of this character. That is especially true with respect to physicians who are not accessible to some well-equipped laboratory or hospital offering electro-therapeutic services. Many in the outlying districts are installing equipment of this kind because of the advantages to be gained in their individual practice, and the larger hospitals and sanitariums find constantly growing use for equipment of this character in the treatment of various ailments.

At the present moment, the Journal is not in possession of any specific information concerning the peculiar characterists claimed for this deep ray lamp by the Hanovia Company from the strictly medical standpoint. The presumption seems justified, however, from an examination of the literature furnished, that it falls within the field referred to, and while it perhaps has no different biological or bactericidal qualities than others on the market, it will probably appeal to many on account of its flexibility and mechanical adaptability.

The lamp itself is substantially constructed throughout, and stands seven feet in heighth, which makes it possible to raise the hood out of the way of the operator when not in use. The hood is counter-balanced, being suspended by a flexible steel cable passing through a triple pulley swivel to a counterweight sliding inside the upright. The attachment of the cable to the pantograph bracket is made to a spring safety lock, which, in case the cable should break, instantly grips the upright and prevents the lamp from falling. A locking device at the bottom of the lamp bracket clamps the bracket to the upright and prevents the hood swinging around on the upright in case the floor is not accurately level. The hood is held to the bracket by a conical friction swivel, which allows it to be rotated and holds it in any desired position.

An adjustable stop is provided on the upright with a spring shock absorber to prevent the lamp being lowered beyond any point desired. The blue incandescent bulb of 1,500 watt capacity can be adjusted as to its focus by means of the little knob shown on the hood cap. This nut engages in a notched slot having four positions and produces at the lowest position an even diffusion of the light and develops a marked hot area at the highest position.

The illustration shows the outstanding features of this lamp.

A—Adjustability of lamp bulb relative to focus of hood to give four steps ranging from even diffusion to a pronounced hot area.

B—Pantograph bracket of ten-inch extension.

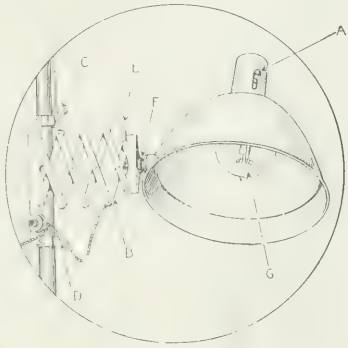
C—Patent safety lock, which prevents falling of lamp.

D—Locking device.

E—Pantograph extension brake.

F—Conical adjustable friction swivel.

G—1,500 watt incandescent bulb.



Nourse Lantern Slide Case

A VERY convenient case for carrying lantern slides is put out by Silas W. Nourse of Palisade, New Jersey. Two views of the case, one closed and the other open, show the case in sufficient detail that it is only necessary to say the case comes in three sizes, with a capacity of 125, 200 or 250 slides.

The case itself is neat, is easily carried, is provided with a lock cover and so constructed that the cover can be detached to avoid tipping over. This is especially advantageous when the operator is working in the dark and prevents breakage. The interior of the case is provided with compartments so that the slides can be arranged in the order desired and as projected shifted to the opposite side so that the slides always appear in proper rotation.

This sort of an appliance will be of interest to radiologists and others giving lantern exhibitions.

ABSTRACTS and REVIEWS

Heliotherapy in Tuberculosis. Horace Lo Grasso, M. D., Perrysburg, N. Y., N. Y. State J. Med., 22:281, June, 1922.

HISTORICALLY, the J. N. Adams Memorial Hospital has shown a significant and increasing practice in heliotherapy since the inauguration of that work in 1913. From the brilliancy of the results obtained the writer suggests that the medical profession generally devote closer study to the therapeutic possibilities of heliotherapeutic measures.

Rigorous attention to established details of technique are imperative for best results. Various indications, contraindications and supporting adjuvant measures are recorded. It appears that the prognosis is favorable in proportion as the patient becomes pigmented. Pain is promptly dispelled. Temperature becomes normal. Appetite returns. Weight and strength improve, as does also the condition of the blood.

There is presented a statistical table showing the results obtained in the treatment of surgical tuberculosis from 1913 to 1922 in many cases. Abridged, the findings are:

T. Bc. Site of infection	Cases observed	Recoveries reported
Eye	15	93.7%
Glands	244	83.0
Peritoneum	63	81.8
Wrist and hand	15	78.0
Ankle and foot	13	72.2
Epididymitis	6	66.6
Hip	35	60.4
Elbow	4	57.1
Osteomyelitis	8	50.0
Knee	13	46.0
Spine	16	32.0
Kidney	4	16.4

The original table is more complete and includes also an expression of the percentages of arrested and improved cases, besides the failures. Lo Grasso says also that heliotherapy is equally as useful in conditions other than surgical tuberculosis: puerperal sepsis, anemia, rickets, osteomyelitis, non-healing wounds and convalescence from all wasting and infectious diseases; and, says the author, the established prophylactic qualities of the rays are more marked even than the remarkable therapeutic properties.

A. J. P.

Newer Aspects of the Rickets Problem. Alfred F. Hess, M. D., Jour. A. M. A., 78:1177, April 22, 1922.

DR. HESS presents a review of a study centered upon the etiology of rickets, in which the roentgen ray interpretation of epiphysecal changes in the relation of vitamine factors in the dietary claim especial prominence as contributing to the modern development of the subject.

Although calcium metabolism has received most of the biochemist's attention, the writer points out the great and significant role assumed by the phosphorus ion.

But, to the student of radiant energy, the contribution is impelling, from the significant presentation of the cogent value of the factor of light in rickets. In summary, the newer advances are these: Light hygiene is as important as dietary hygiene; ultra violet energy is an integral function regulating the appearance and disappearance of rachitic symptoms (as measured clinically and by the x-ray). The quality and quantity of ultra violet radiation is the essential factor—the quality being determined by photospheric filtration, and filtration through glass, the quantity being estimated from the seasonal incidence of the condition.

There are other far reaching experiments recorded, as, for instance (again pointing to selective filtration) the combined effect of pigmentation, the diet and ultra violet energy. There is intimated here the biologic sensitization conferred by certain ions. It is strikingly significant to observe that under the direction of this same author, earlier and empiric attempts in the use of ultra violet energy in rickets resulted in findings that were as disappointing as the recent attack, scientifically evaluated, was successful. A. J. P.

Syphilis of the Aorta. C. W. McGraven, M. D., *and* Ernest Scott, M. D., Ohio State M. J., 18:477, July, 1922.

THE experience of these writers is that the cardiovascular system is the most frequent and vulnerable point of attack for the spirochetes. While the physical findings are of great value in the recognition of aortitis, the fluoroscope and radiograph is the most accurate and certain means of recognizing the condition and determining its extent.

Every luetic patient should be suspected of having aortic or cardiac involvement, and this should be watched for with the same care with which one looks for an endocarditis in rheumatic fever.

Seven illustrative cases are given with radiographs (Dr. J. H. Vorhees, roentgenologist), showing aortic enlargements and aneurisms.

W. W. W.

A Case of Apparent Dextrocardia—Disproved by Instrumental Investigation. John Walker Moore, Kentucky M. J., 20:392, June, 1922.

THIS interesting case illustrates the possibilities of deceptive physical findings. There was an impulse, corresponding to a heaving "apex" beat in fourth and fifth interspaces just internal to the right nipple, and no visible apex beat to the left of sternum. The writer and an intern found all the physical signs to the right of the sternum instead of the left.

The electrocardiogram and the fluoroscopic examination showed a perfectly normal heart in the usual left sided position, the x-ray image extending four fingers breadth to the left and only three to the right of the sternum.

W. W. W.

Some Observations on Endoscopy with Report of Four Cases. C. N. Peeler, M. D., *and* C. C. Phillips, M. D., Southern Medicine and Surgery, June, 1922.

IN endoscopic work, the introduction of the instruments is an easy task, but the plan of procedure in removing the foreign body is the great difficulty. The surgeon must have a mental picture of the location, position and relation of the body to surrounding tissues. In this, the x-ray is indispensable. With the opaque foreign body the task is easy, the only point which requires special attention being to determine whether the body is in the esophagus or the air passages. In the case of a non-opaque foreign body, the difficulties are greater; the signs, although few, are conclusive. The signs in the radiogram are emphysema of the obstructed lung, with widening of intercostal spaces, diaphragm depressed on affected side and mediastinum displaced toward the opposite side. On the fluoroscopic screen, the diaphragm is limited in motion or immobile on the affected side, with exaggerated movements on the opposite side.

The cases reported were (1) open safety pin in esophagus; (2) (prob-

ably) small pieces of cocoanut in bronchi; (3) half of peanut in right lower bronchus; (4) diagnosis of foreign body in left bronchus, proven to be congenital stenosis of same.

W. W. W.

Radium Emanations in Exophthalmic Goiter—Blood Vessels of Adenomas of Thyroid. Wallace I. Terry, M. D., Jour. A. M. A., 79:1, July 1, 1922.

THIRTY-THREE cases of exophthalmic goiter have been treated by radium emanation at the University of California Hospital. Only patients suffering from an extreme degree of hyperthyroidism has been treated and only with the idea of rendering them better risks for major surgical operations.

The skin at the selected sites for treatment is first chilled by use of a cotton sponge saturated with ethyl chlorid. The tubes are then introduced by means of a small caliber, hollow needle and are pushed into place by a plunger. Six emanation tubes containing a total of from six to ten millicuries are inserted into the upper, middle, and lower thirds of each lobe through one skin puncture on each side and are buried one-half centimeter in the thyroid. No adhesions have resulted from this treatment except minute ones where the needle has entered the gland. Tubes as well as needles are sterilized by boiling.

Final results have been obtained in 16 of the 33 cases—ten patients are definitely cured after resection. One of these had diabetes mellitus, which has since disappeared; another with profound toxemia with jaundice, practically moribund at the time of treatment, is now well except for a slight irregularity of the heart. In two cases apparent cure has resulted from use of radium alone; in these two there was a remarkable fall of the basal metabolic rate. Four cases died; three of these died after resection, one dying from acute hyperthyroidism, one from recurring hyperplasia of the thyroid and marked hyperplasia of the thymus, with terminal pneumonia, and the third from acute yellow atrophy of the liver. A fourth one died three months after radium, cirrhosis of the liver being the cause of death.

Neither simple colloid goiters nor adenomatous goiters have been treated with radium emanation. It is conceded that it might be worth a trial in the former, but not in the latter type, for fear of producing atrophy of the thyroid gland and consequent hypothyroidism.

Basal Metabolic Rating as a Basis of Classification and Treatment of Thyroid Conditions. Hamilton P. Jones, M. D., New Orleans M. & S. J., 75:28, July, 1922.

ON the basis of the rate determinations the treatment outlined is as follows: In hypothyroidism, subnormal rate, thyroxin, thyroid extract and iodine may be used, but not x-ray or surgery. In malignancy or tuberculosis everything available may be used, including surgery, radium, x-rays, thyroid extract, etc. Colloid adolescent goiter, normal basal metabolic rate, is an essentially non-surgical condition and is not to be treated by radium or x-rays. In simple adenoma conservative treatment is called for. In toxic adenoma and exophthalmic goiter treatment may consist of surgery or of radium and x-rays—preferably radiotherapy should be tried first.

W. W. W.

Diagnosis of Pulmonary Tuberculosis. Louis Hamman, M. D., Southern M. J., 15:523, July, 1922.

IN spite of the persistent, vigorous and comprehensive campaign of education of the past twenty years, the early stage of tuberculosis still eludes us. This is due to the indifference of patients in this stage, the negligence of physicians, and the difficulty inherent in expert pulmonary tuberculosis. The diagnosis of tuberculosis consists in making a distinction between infection and disease.

In considering the part that roentgenology plays in the diagnosis we must not forget that the x-ray examination is only a part of the physical examination. There is nothing characteristic of tuberculosis in the physical signs themselves, but the location of them is of considerable importance. One of the great advantages of the x-ray is that an accurate and permanent record of the lung density at the time of the exposure may be thus obtained. It also reveals the pulmonary changes in greater detail and it may show surprising changes in a lung which revealed nothing abnormal at the physical examination. "If you discover slight abnormalities the x-ray will show more extensive lesions." The great shortcoming in physical examination is the difficulty of distinguishing between active and inactive lesions and the same thing is true of x-ray examination. The detection of apical rales is the one feature of physical examination which has an advantage over the x-ray. The x-ray is indispensable to an accurate pulmonary diagnosis but no physician should rely solely upon this for his diagnosis. The physician and the roentgenologist should work in close co-operation.

W. W. W.

Thyroid Therapy. R. G. Allison, M. D., Minnesota Med., 5:404, July, 1922.

THIS paper reports results obtained on material coming under the observation of the medical service of the University Hospital during a period of about 20 months. This material consisted of 27 cases of Graves' disease, not operated but treated with x-ray. Twenty-four of these are well from the clinical and laboratory standpoints after eight months.

All cases were treated with a standard dosage at three week intervals. Technique was 30 milliampere minutes through 4 mm. of Al and one thickness of leather at an average distance of 8 inches and a gap of 8 inches between blunt points. Three portals of entry were employed, one over each lobe and one over the thymus. If improvement was not marked after the fourth treatment the time was increased to 34 milliampere-minutes.

The closest co-operation between the internist and the roentgenologist is insisted upon, so that the clinical observations and metabolic determinations shall be carefully watched.

W. W. W.

The Dose of Radium. Heber Robarts, M. D., Illinois M. J., 42:15, July, 1922.

DR. ROBARTS read this paper before the Illinois Medical Society in November, 1921. In it he reviewed the history of radium dosage from 1903 to that time. The following paragraphs are excerpted: "All apparatus thus far contrived for measuring these wide variations of radiance at the therapeutic end is a failure. Ionization is the ray effect, and the number of rays absorbed determine the number of ions. This is the nature of the dose. Reaction occurs in the cells where the rays are absorbed.

"The dose of radium is now put forth with the claim of great exactness; but it is theoretical." Speaking in this connection of simple mucocutaneous cancers he says: "The fact is the emanation needle is a dying product hour by hour. It is impractical, for experience has shown in actual practice that radium must rather increase in radiance than diminish. Diminishing dosage begets tolerance in malignant cells. Tolerance means stimulation and cell proliferation. At first the emanation is very destructive. A film is formed about the needle, which becomes a foreign substance in any tissue. This acts harmfully by (1) adding a filtering crust, (2) leaving an irritating foreign substance * * * My card index reveals that nearly all physicians writing about the superiority of the emanation are those who have recently come into

the fold, and their ability as advocates surpasses their clinical findings. I am in complete accord with those using the emanation needle in deep therapy. No one has been able to apply a fixed therapeutic theory successfully to pathology. * * * Radium is not a cureall. Diagnosis is usually an hypothesis; so no one should rely too much upon the type of the disease for the dose. In every case judgment should be in evidence and there should be some knowledge of the physics of radium, and also some experience. * * * Patients have died from disease induced by radiant matter.

"Look lightly upon foreign literature when seeking the dose of radium. The Freiberg teaching by Koenig and Friedrich is to use heroic doses, and the Hamburg school, headed by Albers-Schoenberg is moderate in its radium therapy."

Treatment of Vascular Naevi. E. H. Molesworth, M. B., Ch. M., Sydney, Australia, M. J. Australia, 1:576, May 27, 1922.

CERTAIN limitations and difficulties in the treatment of vascular naevi exist. The superficial port-wine stain is not nearly so amenable to treatment by radiation as is the proturberant naevi of the strawberry variety and an actively growing naevus is much more easily treated by radiation than one which has attained full growth. The first six months of life is therefore the most favorable period to attack these, and an almost perfect result may be obtained with eventual obliteration of the scar. Radiation undertaken later than the first six months of life may perhaps be preferable to any other form of treatment, but once the naevus has become fixed results are never so good, and in cases of adult naevus if a single dose of radium or x-rays fails to produce a noticeable improvement treatment should be at once discontinued, as continued applications would produce very harmful results. Too heavy treatment is dangerous.

Electrolysis is useful only in cases of spider naevi. This method as well as cauterization often leaves bad scars and besides both are very painful methods. Carbonic acid snow is recommended if radiation is impossible and if this method is impossible then excision is the next choice.

"In suitable cases the method of procedure is as follows: A three-quarter or a full erythema dose of medium to hard (four to six B. W.) x-rays is delivered in one sitting. Of course, the naevoid area alone is irradiated, the surrounding skin being protected either by a suitably-sized localizer, or, if such be not available, by a sheet of lead foil or lead rubber tissue with a hole the size of the naevus cut into it. The effect of the application is, of course, not at once apparent, but at the end of ten days there is generally a noticeable engorgement of the naevus, is quite transitory and followed a week later by distinct flattening and paling of the growth. Three or four weeks after the first application a second dose may be administered; this often results in the complete disappearance of the blood tumor. A third or even a fourth application may be required, but if full erythema doses have been given it is rarely necessary to continue further. Naevi which resist treatment partly or entirely by this means, in my opinion, should be dealt with by some other means of treatment."

The Use of X-rays in Diseases of the Skin. G. E. Richards, M. B., Canadian M. A. J., 12:478, July, 1922.

FOR ringworm of the scalp, treatment must be preceded by shaving, or at least clipping the hair very short. The scalp is then divided into four areas which are treated in rotation, the dose being evenly distributed and so measured as to produce complete epilation, after which "the ringworm of the skin surface * * * can easily be destroyed by the usual applications."

Favus is similarly treated. It is better to treat sycosis and folliculitis barbae by small divided doses "in the same manner as other chronic infections of the skin" and treatment must be continued for some time to destroy all foci of infection. Epilation of the whole area, however, is unwise if the infection is extensive.

Lupus vulgaris is easily, inexpensively and effectively treated by x-ray.

Epithelioma of the skin, if treated before ulceration or increased growth has taken place, yields in nearly 100 per cent of cases, but if attempted in the latter stages treatment is not so successful. Epithelioma of the lip, if not deeply infiltrated, may be successfully treated by unfiltered radiation, but heavily filtered radiation will be necessary in infiltrated cases. In any case the submaxillary glands should be treated by heavily filtered rays.

Rodent ulcer, if it has not involved bone or cartilage, or if it has not been previously treated, will usually yield. Severe reaction at the very first treatment must be sought. Long continued protracted doses will lead to failure.

The whole group of eczemas are successfully treated by x-ray. Psoriasis gives erratic results, but a trial is justifiable. Acne vulgaris and chronic furunculosis, as well as carbuncle, respond very favorably with the exception of the carbuncle which occurs upon the back of the neck. About three-fourths of an erythema dose is used for this lesion. Dosage in all above lesions must be kept under the point of erythema.

Etiology, Pathology, Prognosis and Treatment of Acne. Charles H. Ball, M. D., J. Oklahoma M. A., 15:198, June, 1922.

AFTER outlining the general and local treatment for acne, both of which are essential, the author dwells at some length on the x-ray treatment. The rationale of this therapy depends upon the fact that the activity of the sebaceous glands can be diminished and exfoliation produced, thus sterilizing the skin. The amount of x-ray will depend on the type of acne. The successful treatment depends upon a flexible technique which adapts the dosage to the needs of each case. Acne requires more experience and judgment to produce results than any skin disease treated by x-rays.

Acne is an entirely remediable disease in every case when properly managed. He believes that the benefits of vaccines, when they have any benefit at all, are more or less transitory.

W. W. W.

Congress of Radiology and Physiotherapy. Brit. M. J., 1:958, June 17, 1922.

THE whole of the first day was spent in discussing the normal and abnormal stomach as studied by the x-rays. The discussion was opened by Dr. Barclay, who stated that the stomach, being one of the most flexible and sensitive muscles of the body, can, therefore, alter its shape very greatly and still be normal in shape. Dr. Gilbert Scott said it was as difficult to describe the normal stomach as it would be to describe the normal face.

In discussing the best methods of examination of the stomach one school held to the view that the screen view alone is of value, the other held that it is of less value than the plate method. Palpation was much discussed—almost all agreed more or less as to its value in diagnosis of ulcer with the exception of Dr. E. I. Spriggs, who stated that absence of pain on palpation is not negative in diagnosis of ulcer.

The discussion of deep-seated radiotherapy occupied three sessions of two days. Both support and criticism of the German methods found place here. Dr. Vilvandre begged radiologists not to let national pride or prejudice divert them from the path of pure science. Dr. Finzi said that the future technique would call for 1,000 kilovolts instead of 200 or 300 and that radiotherapy would then be much simpler, more accurate and more effective.

Mr. Sampson Handley said that he believed radium tubes should be placed in a ring just outside the visible focus of disease and that the growing edge of the infection was the important thing, and heretofore too little considered, as was also true of microscopical extension. Also he said that he believed that in placing radium tubes into the mediastinum extensive surgical procedure would soon find a place.

There was a general agreement that radium and x-ray should accompany each other in the treatment of malignancies. Mr. Hayward Pinch of the Radium Institute said that the use of surface applicators for radium was not ideal, but often necessary, and that he believed that surgical procedure would be called in oftener in the future to assist radium treatment and that larger quantities of radium would be used.

Some remarkable photomicrographs of cancer cells and their changes were shown by Professor Daels of Ghent.

The Present Status of Radiation Therapy. D. Y. Keith, M. D., Kentucky M. J., 20:411, June, 1922.

THIS paper gives a general review of the development of radiation therapy and methods of measuring dosage. It briefly describes the objects sought in the newer technique of high voltage therapy, by means of which a more effective dosage is delivered to internal malignancies.

Three cases illustrate the many points in this paper, written for the general practitioner. One case was a carcinoma of the sigmoid and rectum, discovered accidentally during an operation for another lesion. The patient was given two series of intensive radiations, and one year later was in the best condition of her life, with her weight increased from 119 to 135 pounds.

The second case was a carcinoma of the ovary with metastases, inoperable. Treatment was by radium only, administered through the vagina, high filtration. Patient was still alive one year after the operation which had disclosed the condition.

The third case was a carcinoma of the prostate, disclosed at operation. Patient received intensive x-ray therapy and now, after one year, is able to attend to business and is free from pain.

The conditions amenable to radiotherapy are outlined.

W. W. W.

Surgery Versus Radiation. Francis Carter Wood, M. D., Long Island M. J., 16:258, June, 1922.

IN the conclusion to this paper Dr. Wood states that the title should have been "Surgery Plus X-ray Plus Radium." "Each has its rightful place in the treatment of cancer and by an intelligent combination of operation with radiation better results in the treatment of neoplasms will undoubtedly be obtained in the near future. But at the present moment we are still far from having any very effective control over the cancer situation."

Radiotherapy does not cause great damage to the tissues, but its painless quality is not so general as is sometimes proclaimed, the pain from the insertion of needles and the nausea and depression consequent upon treatment often lasting for days or even weeks. The important question, however, is whether it cures or not, and to this the writer replies that the evidence is not yet clear nor satisfactory and that there is still much to be learned before radiation treatment will be upon a satisfactory basis. He says it "as yet impossible to judge whether or not radium or x-ray produces permanent cures of any malignant neoplasms except the basal cell tumors of the skin." Myeloid sarcomata of the long bones is noted as a possible exception to the statement just quoted. "Carcinoma of the cervix is one of the most promising fields for radiation."

Since the technique of radiation treatment has passed out of the realm of pure empiricism only within the last few years, he states that it is impossible to be sure as yet that it does cure malignancies, except clinically, and "Inasmuch as surgery has to its credit a large series of permanently cured patients, it is in my opinion still unjustifiable to substitute for it any other procedure until an equally good body for the latter is obtained. * * * Animal experimentation has shown that tumors exposed to large doses of either radium or x-ray reappear only after long periods of time, and I believe that in judging of radiation results it is necessary to extend the five-year period. Even without this extension the figures, although presented by the most optimistic worker in the vineyard, do not as yet in any way equal the final results of surgery."

As to pre-operative and postoperative raying, he says: "Intensive raying of the growth only, with very heavy doses lethal to all the tumor cells exposed is a possible procedure, but only in tumors near the surface, in which the growth and the entire radiated skin area is excised within twenty-four hours. Postoperative raying, when properly done, in the opinion of many reliable radiologists produces important results. The technique is still in the process of development and there is much to learn, but as it supplements the work of the surgeon the procedure should never be omitted."

Dr. Wood states that tumor surgery must be greatly improved and extended, must become bolder and must be applied in more carefully selected cases than it has been in the past.

In the discussion following this paper Dr. William Francis Campbell said that operative methods for the cure of cancer have reached the limit of their anatomical perfection, that there is no way of extending or refining the operation and yet the cures are lamentably few and he wonders if it would not be better to abandon any but extirpation of the primary focus and leave the rest to radiation, which will seal up the avenues of invasion rather than opening them. He believes that the stage has not yet been reached where one may ask whether surgery or radiation is preferable for a malignancy, but that surgery plus radiation should be the treatment. Dr. J. Bion Bogart said he wished to support the views expressed by Dr. Campbell. He added that he had given up operating for cancer of the cervix, believing radium to be better for such cases.

An Experience With Radium. T. H. Dreher, M. D., J. S. Carolina M. A., 18:158, June, 1922.

THIS paper was read before the South Carolina Medical Association in April of this year, bringing a serious charge against radium therapy.

A case of uterine growth, the subject being the writer's wife, was treated with radium at a sanitorium ranking among the highest in this country, and where the writer took his wife for treatment with the utmost confidence. The results were disastrous and all but fatal. The writer feels that a great mistake was made and charges that it was unacknowledged as well.

In the considerable discussion following the reading of this paper, while the greatest fairness was observed, no one denying that a mistake had been made, and the greatest sympathy and regret expressed, nevertheless unreserved condemnation was not upheld. Radiotherapy in general and the particular institution where the mistake was alleged to have taken place were stoutly defended even by those whose sympathies were the most deeply stirred.

Dr. Deaver had been quoted as condemning radiation. Dr. Charles Mayo and Sir Benton McKenzie were both cited as having rebuked Dr. Deaver a day or two after he was reported to have utterly discountenanced radium therapy.

Radium with Special Reference to Disease of the Female Pelvis. John B.

Deaver, M. D., L. L. D., Therap. Gaz. 46:457, July, 1922.

DR. DEAVER'S much discussed attitude toward radium therapy can be accurately ascertained from the following excerpts from the above paper, which was read before the College of Physicians of Philadelphia:

"In the legitimate and truly scientific field, so anxious is the profession for real light in the pursuit of its course toward eliminating physical suffering, that there is danger of smothering each new discovery in an over-enthusiastic embrace. This applies with particular emphasis to radium in the treatment of cancer." He goes on to say that most of the exaggerated reports about radium may be blamed to the public press, and to say that his paper is an attempt, not to belittle radium, but to correct some false impressions which have been created mainly by the lay press.

"No right thinking person for a moment denies the palliative effect of radium in the treatment of advanced or inoperable cancer, nor does any one doubt its curative value in certain types of superficial external cancer. A careful study, however, of the literature shows that really scientific observers agree that radium is not the panacea which the lay mind has been led to think it is. Furthermore, there is an almost general consensus of opinion that radium therapy is still in its experimental stage, coupled with the desire that its future development will be such as not to frustrate the ardent hopes of the many thousands who are placing confidence in it."

Taking up the specific subject of internal tumors he says: "On the whole, Baisch, once an enthusiastic radiologist, frankly states that 'the high hopes aroused by radium have not been realized.' Good results are obtained only in very early cases, while in the latter and advanced ones the end results are not any more satisfactory than those obtained by radical operation. On the other hand, recurrences after radium treatment seem to grow and metastasize much more rapidly than recurrences after operation, and do not yield to radiation, while the operated cases with recurrences are said to be not quite so intractable."

Citing an operative mortality of five per cent and five year curability of 27.6 to 34.2 per cent from Graves, Pemberton and Cobb, he says: "It is in view of such figures that operation in operable cases should still be considered a choice, if not the chosen method of treatment, for cancer of the uterus and uterine cervix." He cites varying opinions regarding pre-operative radium treatment. "Postoperative radiation, however, is more generally approved as a possible means of destroying cancer cells that may have escaped the knife at operation. The combined treatment is by many considered more successful than one or the other alone, although Clark and Keene warn against radiation soon after operation on a fresh operative field. * * * I am inclined to think, however, that the best results will be obtained by a combination of radiation and surgery; that is, provided the patient is otherwise in good condition, operation after the first or second reaction from radium. * * *

"In benign disease of the uterus and adnexa radium therapy occupies a prominent place. I need scarcely stress the point, however, that the presence of inflammatory disease of the uterine appendages constitutes a contraindication to the use of radium in otherwise favorable conditions for its application. * * * Personally, I cannot subscribe to the use of radium for uterine fibroids, except where there are definite contraindications to operation. The mortality for operation in fibroids in my hands is so small that I cannot conscientiously advise radium except for the reason above indicated. The artificial menopause which it may produce in young women is to say the least serious, while the results are not too inviting in the woman at or beyond the menopause. No one can ever be sure that there is not some latent chronic infection in the fallopian tubes. I speak from experience in making this statement because I have in mind several instances that have come to operation for just such a condition, where radium applications had been made by the so-called expert. In two instances at least, both occurring in the same year, I have known death to result from pelvic suppuration following the application of radium for small uterine fibroids. Fistulae, necrosis, fibrosis, are some of the sequelae of the application of radium, but I have never experienced any of these morbid conditions after operation for fibroid.

"Whatever may be the future of radium therapy, the fact remains that it is today not the panacea for cancer the advent of which is so eagerly being awaited, for in numerous cases in which it is most needed it has not as yet fulfilled expectations."

A British Medical Association Lecture on Radium Therapy. Robert Knox, M. D., Brit. M. J., 1:631, April 22, 1922.

NEW therapeutic agents pass through the stages of over-estimation, depreciation, and sometimes rejection. In such an agent as the radio-active substances great care is necessary in estimating their value and even an approximate estimation is exceedingly difficult.

Much useless discussion has taken place as to the relative value of the x-ray and of radium because, given equal wave lengths of either, the effect must be the same. The real difficulty lies in the fact that it is impossible as yet to perfect an apparatus which will make available x-rays equal to the gamma rays of radium, since a voltage of from one to two millions is required to produce an x-ray equal to the hardest gamma ray of radium.

In a discussion touching upon the physics of x-ray it is noted that the chief difference betwen x-rays and light rays is one of length, the x-rays having wave lengths about 5,000 times shorter than light waves. Only about one octave of light waves is visible to the eye. The radiologist's path is much more difficult than it would otherwise be and the results often not what they should be because even such elementary knowledge of physics as the facts just noted have faded from his sight since he first studied physics.

Radium is defined as: "The prominent member of the uranium series of radio-active elements, belonging to the alkaline earth group of elements. Its parent is ionium and its disintegration product radium emanation." As generally used the word radium signifies a radium salt, and it is more accurate to state the radium element of the salt in speaking of other salts which are used in radium preparations. An explanation of beta and gamma rays is made and the alpha rays mentioned.

Action of radiation upon the tissues is next discussed. In the following outline Dr. Knox indicates the present situation with regard to choice of treatment:

Non-Malignant Growths

1. Port-wine stain, so-called—use care in treating, else the disfigurement will be worse than the original condition.

2. Angiomas — entirely removed from the surgical field.

3. Uterine fibroids—radium and x-rays the treatment of choice in 40 per cent of cases, but proper selection very necessary.

4. Uterine hemorrhage — radium almost a specific, but cause of lesion should first be ascertained in consultation with the gynecologist. In subacute and chronic leukorrhea radium found efficient where other measures have failed.

5. Bladder papillomata — radium used after operation or fulguration.

6. Goiter—agent of choice is exophthalmic goiter, useful in inoperable hypertrophic goiter.

7. Leukemias—offer a large palliative field. In many severe leukemias it is believed that raying the spleen, with transfusion, is the treatment of choice.

8. Enlarged thymus in children—Heublein believes radiation is the treatment of choice.

9. Cataracts—recent reports favor radiotherapy for this.

10. Tuberculous adenitis — Knox believes that a surgeon seeing results following treatment by radium and x-rays would adopt it at once either with or without surgery.

Malignant Growths

1. Skin cancer — if inoperable radium treatment of choice.

2. Lip cancer—if springing from the skin surface radium occasionally is used; if from the mucous membrane, and in a very early stage, surgery and radium should be used and x-rays used over the glands of the neck and chest. The advanced cases call for radium, and x-rays over the growth and the glands of neck and chest.

3. Cancer of lingual and buccal mucous membrane—radium and fulguration. The knife must not be used for these lesions. Salvarsan is used at the height of the radium reaction for secondary effects.

4. Malignancy of antrum—operation plus radium, glands rayed.

5. Cancer of the esophagus—if in an early stage combine radium and surgery; for later stages radium is a palliative, but in any case great care must be exercised, as the danger to adjoining tissues is especially great.

6. Stomach and intestines — surgery, plus radium, if possible.

7. Breast—surgery and postoperative radiation in early stages; inoperable cases often rendered operable by radium, which is employed only for the inoperable or advanced cases.

8. Rectum—no satisfactory treatment—if inoperable treat by radium and x-ray employing colotomy to avoid irritation.

9. Prostate—surgery and radium tubes in operable cases, otherwise radium needles by way of the perineum or cross-fire method by way of the rectum and urethra.

10. Bladder — Suprapubic operation to facilitate placing radium and for drainage.

11. Fundus of uterus—surgery if an early case; palliative treatment for all inoperable cases.

Much of the work of radiotherapy in the past has been experimental and empirical. Technique has often been exceedingly crude and too often used in the hands of men whose skill and training have not been such as to permit attainment of the best results, but in present day therapy haphazard methods have no place. "Many disappointing results have followed the use of radium in quite unsuitable or hopeless cases."

As to end-results, he says: "A number of cases in which recurrence has shown itself within the five year period have cleared up and remained well. On the other hand, it is just at the five year limit that I would look out for manifestations of deep-seated secondary deposits, and I would place the critical period upon which statistics may be based, which would be of value, between five and ten years." This is applicable, he states, chiefly to carcinomata. "On the whole results are not good."

As to the future of radium. he says: "The possibilities of radium in the treatment of disease have not nearly been exausted; in fact up to the present the technique has been more or less experimental. The experience of recent years brings forth two dominant facts. The potency of radium is now acknowledged by all competent workers; it is a most valuable adjunct to the surgeon and the x-ray therapist. Indispensable to both it is clear that a great future lies before it."

In his closing paragraphs he has this to add upon malignancies: "The question of radiations versus operation must now be discussed. In all cases, with perhaps one or two exceptions, there can be no doubt that the operation should be the first choice. In all cases where possible radium should be used at the operation, placing it in positions which are likely to contain residual cells."

Radiations in the Treatment of Cancer. A lecture by Robert Knox, M. D., Lancet, 202:1121, June 10, 1922.

AT the Cancer Hospital, London, operation is urged in all operable cancer cases and radiation is used subsequently. If operation is precluded then radiation is used. Border-line cases present the greatest difficulty of choice, and among these are mentioned carcinoma of the rectum, esophagus and cervix uteri.

Whether x-ray or radium is used matters very little "if the correct dose of the correct wave-length can be delivered at the site of the lesion." The "lethal" cancer dose cannot yet be accepted as proved and dosage must be determined in each individual case.

Blood examinations Dr. Knox regards as very important and states that they should be continued at regular intervals throughout treatment as well as just at the beginning. This is for guidance in treatment as well as for the sake of research.

The use of the higher voltages calls for protection of operator and patient from shock, over-exposure and inhalation of deleterious gases.

Full credit is granted German workers for their newer methods, but the impression prevalent in some sections of the medical world that German apparatus is superior to any other and requisite for the best results is a mistaken one. Both the French and the American apparatus is excellent, and sound work, in no way inferior to that of the Germans, has been done in France, England and America.

In Germany three or four anterior and as many posterior areas, each directed toward the area of disease are used. This admits of more penetrating radiation, administration of a long dose and the introduction of a comparatively accurate method for measuring dosage.

Dr. Knox uses a similar method, though on account of the limitation of current the shorter wave lengths cannot be used. A dose of the value of a full pastille dose measured on the distal side of the filter is sought. Twelve to thirty areas have been used—even as many as forty for deep-seated mediastinal lesions. As good results have been obtained in a number of cases as those claimed for the Erlangen method. As a rule x-ray has been supplemented by radium tubes.

A well known authority, Dr. Knox states, has suggested that all treatment along old lines should be discontinued because if any portion of a tumor receives 40 per cent of an erythema dose stimulation of the tumor growth will result. This Dr. Knox regards as an alarmist's view not upheld by experience. "What may be a stimulating dose for cancer cells is also apt to be a stimulating dose for normal tissue," strengthening its natural power in the fight against the malignancy. Full treatment by the Erlangen method holds the possibility of deleterious effects during the period of depression following treatment.

The mechanical details of the rotating tube mechanism used by Dr. Knox are described. Its advantages are (1) accuracy of application; (2) possibility of repeating at subsequent exposures the dose primarily given; (3) radiations can be varied in depth and latitude in order to influence all portions of the growth; the focus point can be fixed in front of, behind or at the center of the growth; (4) two or more doses can be directed to the center of the growth and a centrally situated growth can be approached from all aspects of the body and a maximum dose given to the area in which the tumor is situated.

In regard to pre-operative and post-operative treatment he says: "Radia-

tions can be used soon after operation, even at the time of operation, and—in cases where time allows before operation. * * * When an operation is arranged for as soon as diagnosis is made pre-operative treatment is not recommended, because if it is to be useful it must be of the intensive type, and this would reduce the patient's powers of resistance too severely."

The writer voices the fear that the newer methods in use at the Erlangen clinic may be used by incompetent radiologists, or may be used upon cases not properly selected and he bespeaks protection for the public. He states that contradiction of the sensational press reports of the results of the newer therapy is the duty of every radiotherapist.

The Mode of Radiation Upon Carcinoma. James Ewing, M. D., Am. J. Roentgenol., 9:331, June, 1922.

DIFFERENT organs of the body have different degrees of susceptibility to radiation, both with respect to structural integrity and functional disturbance, e. g., the skin is more resistant than the buccal mucosa, which in turn has greater resistance than the rectal mucosa. Bladder mucosa is notably susceptible, but brain tissue unexpectedly resistant. Normal lymphatic tissue may be surprisingly unaffected by radiation, which destroys neighboring malignant growths.

Age and associated pathological conditions must be taken into account in calculating dosage. Cardiac disease and anemia are specifically mentioned here.

Anything like an absolutely uniform standard of reaction of tissues, therefore, does not exist and dosage cannot be regulated by pure physics indispensable as is physics to radiotherapy.

In tumors the variation of reaction (which depends upon tumor structure) is particularly remarkable and is accounted a primary principle to be considered in treatment. Various types are discussed and the author says that "Unless the operator combines with his powerful physical machine a considerable knowledge of the pathological anatomy of tumors, he may have many surprises and disappointments and may somethimes do more harm than good."

He warns against "the common assumption that diminution in bulk is a reliable criterion of effective radiation or increase in bulk a proof of growth. Often reduction in bulk means merely absorption of fluids, slowing of secretion, draining of cysts, or closure of vessels with central necrosis, while peripheral cells remain intact.

"When a tumor swells following radiation it is generally due to hyperemia, swelling of tissue cells, and exudation of serum, blood and leukocytes." Mucinous degeneration, hemorrhages and bulky exudates or bacterial infection may produce the same effect of swelling. When all these sources of increased bulk are eliminated from the problem there is little ground left for the so-called stimulation of tumor growth.

In regard to the "killing dose" the writer says that the fact that a piece of extirpated cancer transplanted after raying, fails to grow is not proof that the dose used in raying it is a lethal dose for that type of cancer, since no account has been taken of the reaction of the living tissues *in situ*.

Several conditions under which the curative action of radium and roentgen rays have often been observed are discussed in arriving at the statement that cure does not depend upon a direct effect exclusively upon the tumor cells, but upon a peculiar reaction of the normal or invaded tissue cells which is as yet not understood. "We need a Virchow, a Waldeyer or a Weigert to solve these riddles."

Through study of the principles of the physiology, pathology and physics involved in radiotherapy is needed.

"Radiotherapy will prgoress more soundly if it follows the spirit of this era, avoids rigid procedures and blanket rules, and makes full use of the new knowledge which the development of this branch of medicine has both rendered necessary and placed at its disposal."

The Underlying Principles in the Radiotherapy of Malignant Tumors at the Surgical Clinic of Professor Schmieden of the University of Frankfort. Hans Holfelder, M. D., Germany, Am. J. Roentgenol, 9:341, June, 1922.

AT the surgical congress held in April, 1921, at Berlin, one entire day was given over to the subject of x-ray treatment of surgical diseases. All the principal surgical clinics of Europe make extensive use of the x-ray.

With the exception of the subject of newer apparatus the following points are fully discussed in this paper:

(1) Rays of a sufficient quantity and power of penetration and a relatively constant output have resulted from the newer apparatus, while successful application is made possible by the development of a technique of measuring which employs the electroscope and the iontoquantimeter.

(2) Uniform results depend upon every single cell in the whole area of growth receiving sufficient and equal dosage. Dosage must be within fixed limits and localized as nearly as possible to the seat of the disease. The whole dosage should be applied at one time and sufficient length of time elapse between radiations to permit the biological reaction to take place.

(3) Cooperation between physicist, radiologist and surgeon is necessary.

The conclusion sets forth the status (Sept., 1921) of clinical experience and the indications which determine treatment at the Frankfort clinic.

A Study of Rickets With Review of Recent Literature. Roy G. Giles, M. D., Am. J. Roentgenol., 9:360, June, 1922.

THE author's summary gives the main points of this paper and is as follows: "Rickets is a chronic acquired disease occurring most commonly during the first two years. Many views have been advanced to account for its occurrence, among these heredity, improper hygiene, infections of various natures, dietetic conditions, etc.

"All the tissues in the body may be affected in rickets, but the principal pathological lesions are seen in the osseous tissues. The cranial bones may show changes in shape and delayed ossification. Scoliosis and kyphosis may be detected in the spine. Dentition may be delayed. Enlargement of the costochondral junction, the so-called "rachitic rosary" manifests itself in the chest. The ribs are bent, porous, slender and have lost their normal inclination and parallel arrangement. The lungs are frequently small and atelectatic. Periostitis may be seen. Fractures may be single or multiple, and are often incomplete. The cartilaginous epiphyses are enlarged and frequently show on the roentgenogram. The diaphyseal end of the shaft spreads outward and its edges are irregular and jagged. The most important changes radiographically are seen in the epiphyseal line of the long bones and neighboring joints."

A Method for Roentgen Ray Demonstration of the Nasolacrymal Passageways. Don M. Campbell, M. D., L. R. C. S., (Edinb.) John M. Carter, A. M., M. D., Howard P. Doub, A. B., M. D., Am. J. Roentgenol., 9:381, June, 1922.

THIS type of examination gives valuable data in deciding what type of operation is to be performed and shows the point where dependent draniage may best be accomplished if an opening is to be made into the nose. Further valuable points are that in cases of partial obstruction it is easy to see what type of sac and duct is present and whether these are suitable for probing, or if an intra-nasal operation is necessary. Postoperative information of

value may be obtained. Whether the sac has been completely removed at the time of operation can be determined and the condition of the sinuses can be noted.

Value of Pyelography Before Undertaking Surgical Measures for the Relief of the More Obscure Types of Abdominal Pain. Vincent I. O'Connor, M. D., Illinois, M. J., 42:9, July, 1922.

THIS series of 28 cases, all referred because of chronicity of the complaint or obscurity of the trouble, are presented for the sake of emphasizing the value of routine urological study in diagnosis of obscure abdominal and pelvic disodrers.

Too many operations are performed without sufficiently considering the possibilities of renal or ureteral pathology. In hydronephrosis an appendectomy is frequently performed before the real trouble is discovered. An extreme range of renal mobility is frequently the cause of right sided pain in adolescent females.

"A careful roentgenological and urological examination may establish the correct diagnosis in cases of obscure abdominal or pelvic pain or discomfort. Lesions of the upper urinary tract frequently exist without subjective or objective symptoms referrable to the urinary tract. Ureter pyelography is frequently the only method by which an accurate diagnosis can be made. In cases where a suspected nephroptosis or angulation of the ureter is suspected, this must be done with the patient both in the prone and erect positions."

Pyelography, Preliminary Report. Oswald S. Lowsley, M. D., Bost. M. & S. J., 186:873, June 29, 1922.

BOTH clinical experience and animal experimentation has lead the author to regard sodium iodide as most suitable for pyelographic work.

His technique is as follows: A preliminary examination is made with the cystoscope to determine it any abnormality is present. Next lead catheters are forced into the ureters to the kidney pelvis, if possible, and specimens preserved for various examinations. A kidney functional test is then made with phenolsulphonephthalein after which a picture of the upper ureter and kidney is made and also one of the lower ureter and bladder before any opaque substance is introduced.

"If stone in the ureter is suspected a double exposure plate is taken after the method of Kretschmer. By following this method a stone in the ureter will be in apposition to the lead catheter and then the x-ray tube is moved laterally. If there is a stone in the ureter it will move with the catheter. If the shadow is cast by an object above or behind the ureter, it will not be in exact apposition to the catheter in the second picture, due to the change in the angle. Then the opaque material is introduced under gentle pressure until the patient states that a sense of fullness is felt in the back. This is done simultaneously on each side, and as soon as the sense of fullness above mentioned is noted the injection stops" and the same views already mentioned are taken.

The patient is then placed in a sitting posture with the middle of the plate at the crest of the ilium for the picture of the entire course of the ureter, a portion of the bladder, and the entire kidney. "Then the x-ray catheters are slowly withdrawn, sodium iodide being injected into the ureter during the process. When the ureter catheter has been withdrawn to a point just within the ureter orifice, the picture is taken, and in this way any abnormality in the contour of the ureter or the position of the kidney will be brought out. * * * As soon as the picture is taken, the catheters are reintroduced a slight distance and the sodium iodide drained off. The instrument and catheters are then removed.

"Most of our patients complain of a considerable amount of pain for a few minutes, which may extend into several hours in certain cases, but only in seven cases have we had elevations of temperature above 100 since we have been using sodium iodide."

Pyelitis of Pregnancy. Fred M. Hodges, M. D., Am. J. Roentgenol., 9:352, June, 1922.

THIS paper reviews the literature and describes with the aid of plates seven cases of pyelitis of pregnancy occuring in the author's practice.

The following technique is said to have given almost perfect satisfaction: "The usual kidney cone; film with double screen; 40 ma.; five inch gap; one-half to one and one-half seconds exposure. Only one side is examined at a time, the pelvis being slowly filled under fluoroscopic control. When the examination is made in this way, the patient is subjected to practically no discomfort or reaction, while a good pyelogram is obtained.

"This subject being still under investigation, any conclusions can only be tentative, but we believe the following summary is probably justified:

"(1) Pyelitis occurring during pregnancy is probably uniformly secondary to obstruction due to pressure on the ureter by the enlarging uterus. (2) Usually, due to the rotation of the uterus to the right, the greatest pressure is exerted on the right side; but contrary to the usual assumption, the left side is in nearly every instance also affected, but to a lesser degree. (3) Be the source and route of the infection what it may, obstruction unquestionably exists, since in every instance immediate improvement followed evacuation of the uterus. (4) Measurements of the pelvic capacity usually give most of the desired information, but the evidence furnished by the pyelogram is conclusive, serial pyelograms giving a permanent record and graphic data which is of value in treatment and prognosis. (5) The true pathology of the condition is graphically demonstrated by the pyelogram and consists mainly of dilatation of the renal pelvis and dilatation and kinking of the ureter. The dilatation varies greatly. The lesser and medium grades will entirely recover, but the more severe grades with atony of the pelvic musculature only partially recover. (6) In women having borne children, a dilated pelvis and ureter, especially if the right side, may be a normal condition, the kidney forming normal urine and having a normal function. (7) The colon bacillus is usually the infecting organism, but others may occasionally be primary or engrafted on the colon infection. (8) The early diagnosis and treatment of pyelitis of pregnancy may be the means of avoiding serious if not irreparable damage to the kidney. (9) Pelvic drainage and lavage is of marked value adding little if any risk when properly done."

Pneumoperitoneum as an Aid in Obstetrical and Gynecological Diagnosis. Earl C. Sage, M. D., Nebraska M. J., 7:244, July, 1922.

THE work of Peterson and Rubin is reviewed by this author. Credit for the interpretation of x-ray findings and the proper positioning of the patient belongs to the late Dr. VanZwaluwenburg of Ann Arbor. The technique of giving gas (carbon dioxide) by the transuterine and the peritoneal route is described.

W. W. W.

A Pathognomic Sign of Intra-Uterine Death. Alfred Baker Spaulding, M. D., Surg. Gynec. & Obst., 34:754, June, 1922.

HISTORY, subjective symptoms and physical signs hitherto have been the only reliable diagnostic aids in ascertaining the death of the fetus, but the x-ray is coming to be recognized in this capacity.

During the recent months in the Women's Clinic of the Stanford University Hospital diagnoses of intra-

uterine death has been made by x-ray pictures of the fetal skull. It has been found that a typical overlapping of the skull bones, to a sometimes astonishing distance, is caused by the shrinkage of brain tissue in the dead fetus. This overlapping gives a very different picture than that produced by molding. The radius of curvature of the shrunken head becomes obviously smaller than that of the unchanged cranial bones, which retain almost the same size and shape. When overlapping together with this smaller radius of curvature occur, the conclusion that death has taken place is justifiable.

"In this series of 21 cases, 3 babies were dead and presented the typical findings; 18 were alive, of which 17 showed no changes in the x-ray picture of the fetal head and the suture lines. One baby showed marked overlapping of the skull bones, due to molding caused by a long first stage of labor, but in spite of this overlapping the skull bones showed no disproportion in relation to the bulk of the contents of the skull."

In 27 controls no overlapping of fetal skull bones nor diminution in size of skull contents could be seen.

From this study it is concluded that shrinkage of the skull contents with overlapping of the skull bones can be demonstrated with the x-ray and these are a pathognomic sign of intra-uterine death.

Roentgenography in Obstetrics. D. A. Horner, M. D., Surg. Gynec. & Obst., 35:67, July, 1922.

THE near future will witness a much wider use of x-ray in obstetrical practice. At present most obstetricians and roentgenologists fear its use upon the pregnant woman, but in the writer's opinion this fear is not justifiable if proper technique is observed; the short exposure then used cannot possibly effect either mother or child.

The writer differs with some others as to the stage at which the fetus may be distinguished. That positive diagnosis is possible at four months is a faulty conclusion in his opinion. Also he states that pneumoperitoneum reveals nothing that the educated finger does not reveal as well.

In later stages the x-ray shows the size and outlines of the fetus sufficiently to demonstrate position (not to be confused with presentation) and for this one exposure before the onset of labor is advised. Stereoscopic views at or just before term give a much clearer picture of the relation of the head to the pelvis and of the probabilities of difficulty in engagement.

In fetometry the writer has found the x-ray of great aid. As to pelvimetry the writer states: "Many defects overlooked in external and internal examinations, e. g., marked contraction of the inlet, sacro-iliac disease, effects of old fractures, exostoses, callus formation following previous pubitomy, etc., can be perceived at a glance." Recognition of the finer points can be secured only by the x-ray, if at all, and then only after much experience in interpreting plates.

As a rule no note is taken of a woman's fitness to deliver a normal sized child. "The grossest deformities of her pelvis are not considered a detriment, even though her first labor will be fatal to her and her child, if not conducted by one specially prepared for all complications."

Intra-uterine death is indicated by overriding of the skull bones plus asymmetry of the head, and these signs are the only positive ones.

In case of the newborn, radiography leads to discovery of any injury not apparent otherwise.

Foreign bodies in the uterus have been incidentally detected by the x-ray a surprising number of times, in one case this discovery rendered a pregnancy safe which otherwise must have terminated unsuccessfully.

Failures After Gastro-Enterostomy Turned to Success by the Knowledge Furnished by X-ray Examination. A. Howard Pirie, M. D., Am. J. Roentgenol. 9:358, June, 1922.

IN cases where gastro-enterostomy has failed the author has searched in vain for a "vicious circle", but has discovered gastric delay in such cases with consequent vomiting as a means of disposal of stomach contents denied egress otherwise. It is quite possible that during vomiting bile may be forced up from the duodenum and expelled with the rest of the stomach contents, and mixing with these give rise to the assumption of the "vicious circle" so often mentioned in the literature.

There are three types of gastro-enterostomy openings. With the first type the food is allowed to escape the stomach almost immediately, but this need not necessarily be a bar to digestion. The second type permits a quick escape of a portion of the stomach contents at first and then gradually slows down the action. This type is also regarded as successful, but the third type causes serious trouble, as it permits of escape only at first entrance of food and then refuses further exit.

In examining these cases the first thirty seconds after the barium is swallowed (upon an empty stomach) yield the most useful information. The screen should be relied upon chiefly, the patient standing in the upright nostro-anterior position. As soon as the barium is seen to pass the gastro-enterostomy opening and to enter the small intestine the patient is turned to the left lateral position so that the opening may be observed from the side.

Two cases taken from the author's practice are sufficiently described in the summary quoted below:

"(1) Vomiting continually for weeks after a gastro-enterostomy is usually due to retention of food in the stomach.

"(2) The gastric delay is due to the stoma being placed too far from the pyloric end.

"(3) Roentgen ray examination not only may disclose the cause, but provide the remedy.

"(4) First case of vomiting after every meal for three months following gastro-enterostomy cured by lying on left side after meals. Second similar case cured by lying on left side and rolling over a pillow on stomach."

DR. CHARLES MAYO in a paper upon the subject of chronic ulcer of the stomach and duodenum (Am. J. Surg., June, 1922) reports that Moynihan almost discredits laboratory tests in diagnosis of these lesions and prefers the roentgenologist's report to any other single finding when making his diagnoses of such ulcers.

High Tension Electric Shocks in Roentgenologic Practice. William F. Hemler, M. D., Am. J. Roentgenol., 9:365, June, 1922.

THE author concludes that the sources of high tension electric dangers are: "(1) Concrete floors in roentgen ray exposure rooms. (2) Metal tables, tubestands, fluoroscopic or switch cabinets within sparking distance of any one who might approach high tension currents, especially if such apparatus is or may become grounded. (3) Any grounded conductor within the room or under the floor unless guarded. This includes all low tension wires, cables to main or Coolidge transformers, foot switches, swinging cables of light switches, all wires of lighting system or wires for any purpose, and radiators, pipes and conduits. (4) Unguarded high tension lines and tube terminals."

Standardization of the Measurement of Tube Potential. Frank Rieber. Am. J. Roentgenol., 9:371, June, 1922.

THIS paper of ten pages is summarized briefly as follows: "A method of measuring significant tube potential is presented. The measurements taken indicate that the crest meter used responds to sustained peak potentials, but is unresponsive to surges and transients.

Spark gap readings when invesitgated in comparison with this instrument, show inconsistences which are partially ascribed to surges. The sphere gap seems to be more sensitive to surges than the point gap, and, therefore, of less use in x-ray measurements. This statement applies for potentials up to 150 kv. Above this value the spheres seem to be the best available method, in spite of their sensitiveness to surges. Kilovolt meters cannot be relied upon unless calibrated against a number of point gap settings at the setting where used. They will then enable consistent return to that point. Disc rectifiers give greater surges and higher and more irregular gap readings for the same crest values than do arm rectifiers. All rectifiers give much more consistent results when closely adjusted."

Treatment of Suppurative Conditions of the Lungs. T. E. Carmody, M. D., New York M. J., 115:742, June 21, 1922.

AFTER discussing the etiology of lung suppurations, the author calls attention to the work of Stewart and Lynah, and makes the additional point of the abnormal distensibility and collapsibility of the affected bronchi. This condition is taken to have an important relation to the poor drainage and failure to resolve found in chronic cases.

Records of six cases are given in which bronchoscopy and aspiration of the pus were performed, using a motor driven pump. The results have been very encouraging.

Abstracter's Note—This paper is indirectly of interest to roentgenologists, since it follows up the work of Stewart and Lynah on the bronchoscopic investigation of lung abscesses, which was reported two or three years ago. Dr. Lynah, it is noted with great regret, has recently died.

W. W. W.

The Pathological Changes Produced in Those Rendered Insensible by Electric Shock and the Treatment of Such Cases. (Papers read before the Section of Electrotherapeutics of the Royal Society of Medicine, March 17th, 1922.) Arch. Radiol. & Electroth., 27:1, June, 1922.

THE introductory paper was read by T. Morison Legge, C.B.E., M.D., D.P.H., H.M. Medical Inspector of Factories. In this paper he says that Jellinek is the protagonist of the view that death immediately after electric shock is apparent and not real, while Jex-Blake in 1913 claimed that it is a real death and due to ventricular fibrillation. If the latter theory is the true one then no amount of artificial respiration will restore life, but Jex-Blake advises long continued artificial respiration, desisting only upon rigor mortis.

Borruttau in 1918 disputed Jellinek's theory with an argument well backed by 340 fatal cases from the records of German factory inspectors. Borruttau claimed long continued artificial respiration to be useless in the absence of apparent signs of heart action. If Jellinek's view is right, then every medical man is duty bound to keep up artificial respiration for hours in cases of unconsciousness from electric shock. British statistics, although inadequate, support the view held by Borruttau.

Mr. Scott Ram (H. M. Electrical Inspector in the Factory Department of the Home Office) holds a questioning attitude. He calls particular attention to the fact that in cases of electrical shock accompanied by an immediate fall from a height of several feet recovery occurs without artificial respiration being necessary. He cites seven such cases which occurred in 1921; the height of the fall varied from 5½ to 35 feet, and although several of these had received very severe shocks, in only one was artificial respiration resorted to, and all recovered.

Most fatalities in his experience within the last iumber of years have come from alternating current, and in two-thirds of these the current was at low pressure. He severely censures the laxity that permits so-called medical electricians, as well as many other people, to install apparatus without knowledge of the dangers to be guarded against.

A Goodman Levy, M. D., M. R. C. P., (Physician to the City of London Hospital for Diseases of the Chest) states in his paper that experimental experience undoubtedly supports the view that death from electric shock is due to fibrillation of the ventricles. This generally proves fatal, but spontaneous recovery may occur in man just as often as it occurs in animals, though not later than two minutes from the onset of fibrillation. Apart from spontaneous recovery such cases are hopeless. It is an unfounded theory to hold that artificial respiration will arrest fibrillation. Immediate cardiac massage may restore heart action, but is impractical because it cannot be applied except in the immediate vicinity of the operating room. Single electric shocks employed within fifteen seconds of accident may be effective, but this also is not a practical method. However, heart and respiration may be paralyzed together. and in anticipation of this condition and of cardiac recovery it is well to proceed to artificial respiration immediately, though its value has been greatly overrated in the writer's opinion.

Professor J. A. MacWilliam, M. D., F. R. S. (Regius Professor of Physiology, University of Aberdeen) adds to the symposium, saying that the modes of immediate death from electric shock are three, namely, (1) arrest of respiration from paralysis of the respiratory center while the heart continues to beat, (2) overthrow of heart action by development of fibrillation, ventricular fibrillation being the determining cause of death, (3) combination of the first two.

There is a relative susceptibility of the ventricles to fibrillation from electrical stimulation which varies greatly in different animals and even in the same animal species and, presumably, in man as well. If the period of ventricular fibrillation is more than a very brief one the central nervous system will probably suffer irretrievable damage, but artificial respiration should be tried in all cases. (To be concluded.)

X-ray Dosage in Treatment and Radiography. By William Daniel Witherbee, M. D., in Charge of Radiotherapy, Presbyterian Hospital, New York, *and* John Remer, M. D., in Charge of Radiotherapy, New York Hospital. Cloth, 16 mo, 87 pp., five illustrations; New York: Macmillan Company, 1922. $1.75.

THIS book deals with the methods of dosage used for the past four years by these authors in both their private and clinical practices. Unfiltered and filtered (A1) dosage are treated of, but no experience is claimed in the high voltages above ten inches. The work, as is stated in the preface, is especially applicable and useful in determining the amount of each exposure in radiographic work. Most of the work has been rewritten from articles already published in various medical journals.

The eight chapters deal, respectively, with unfiltered x-ray dosage; x-ray burns in radiography; filtered x-ray dosage; principles of x-ray burns; cause of x-ray burns; treatment of focal infection of the throat by x-ray compared with surgical removal of tonsils and adenoids; x-ray treatment of skin diseases; x-ray treatment of uterine fibromata, menorrhagia, leukemia and Hodgkin's disease.

This little book is a handy and useful compendium of the author's technique as outlined above.

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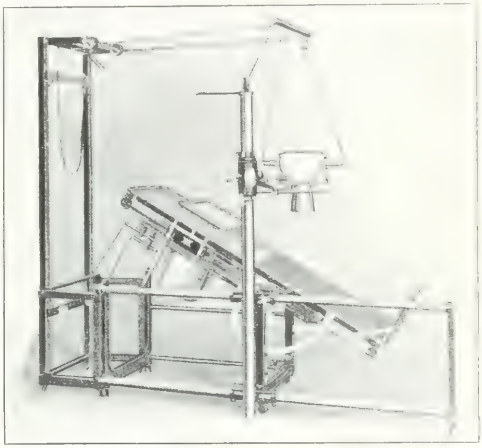

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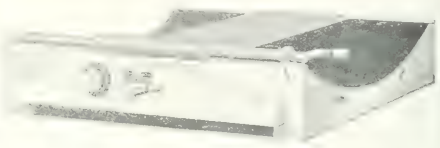

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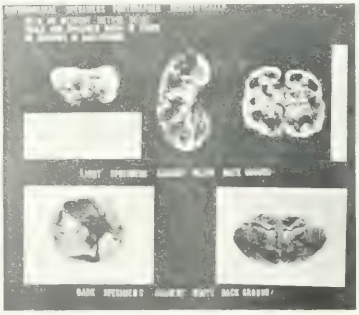

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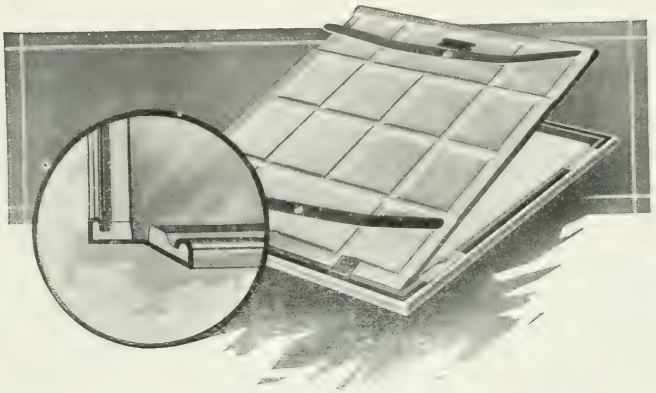

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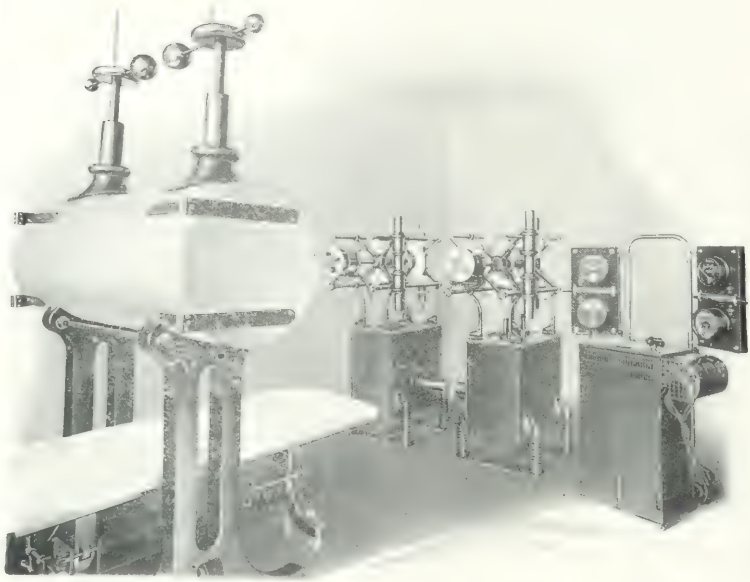

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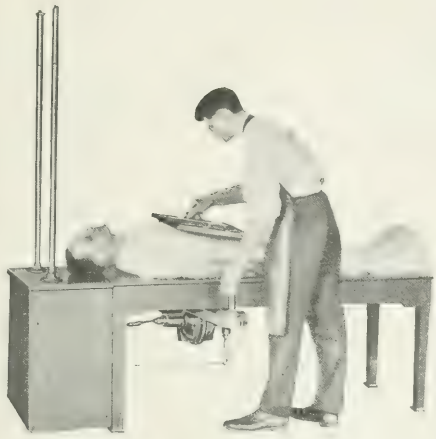

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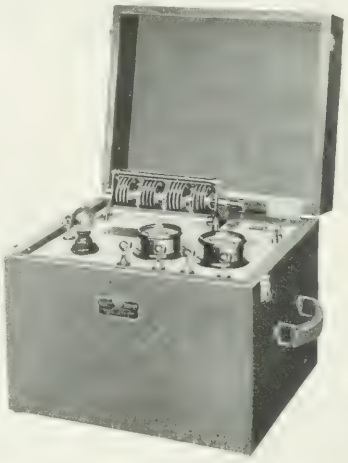

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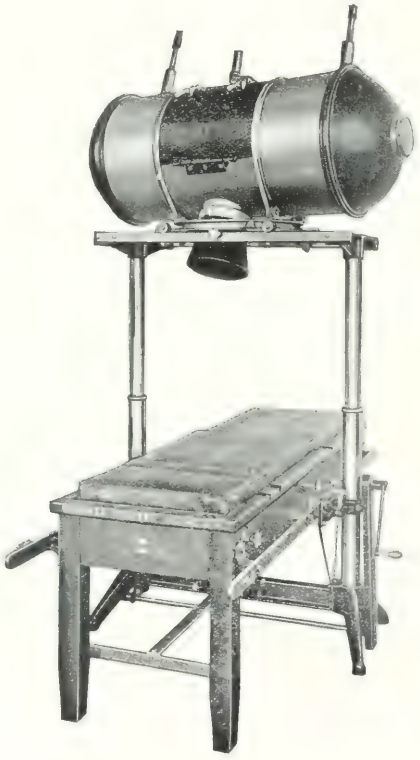

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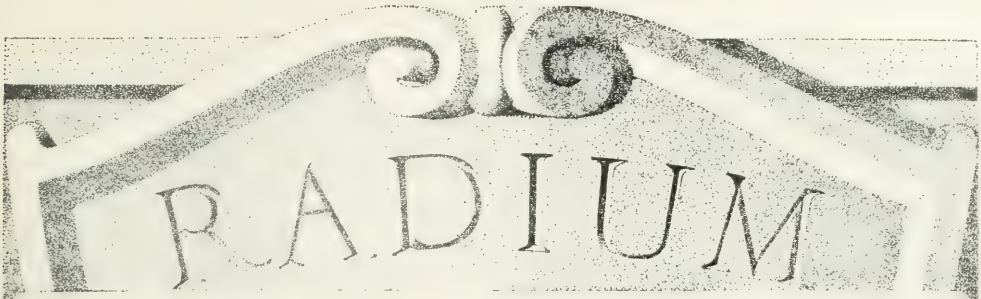

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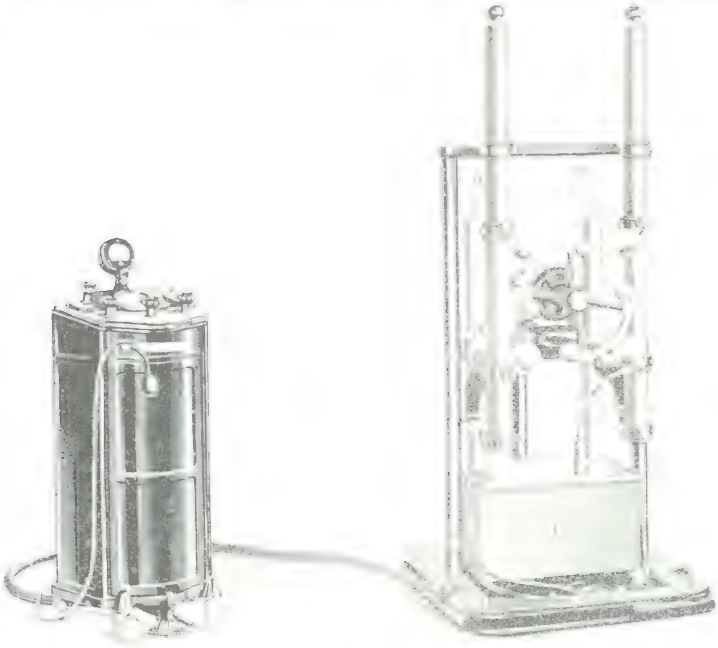

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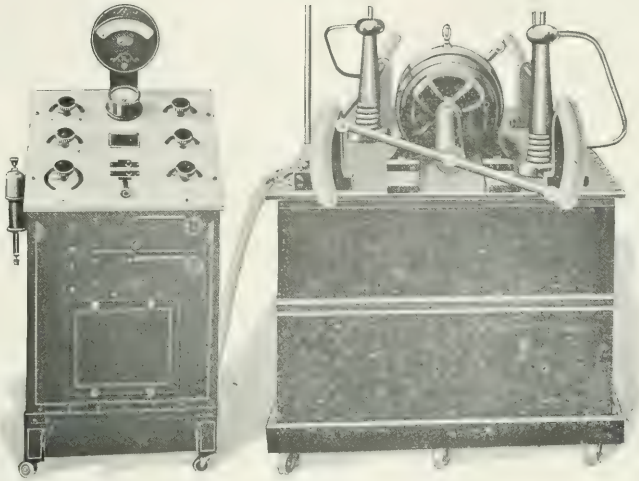

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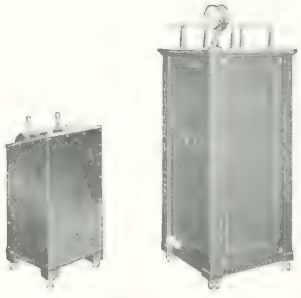

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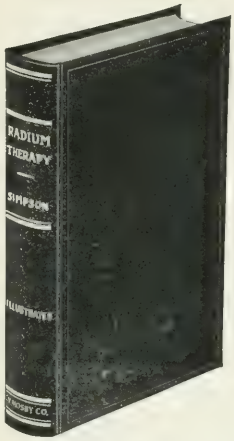

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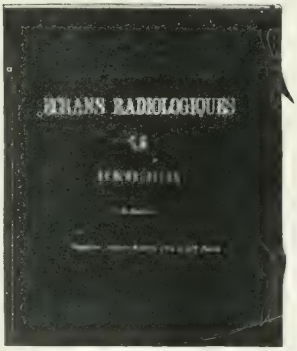

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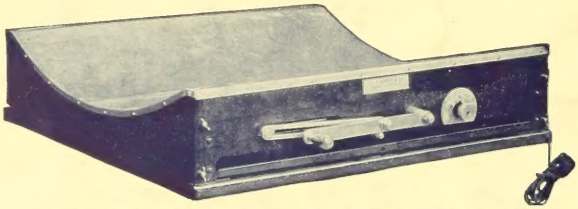

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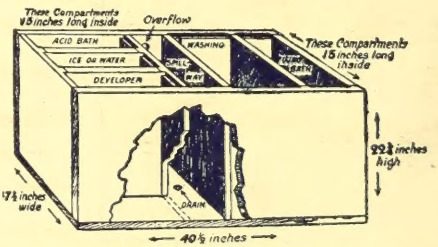

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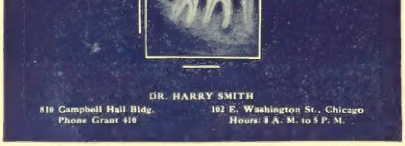

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